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Agriculture

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Pail-feed

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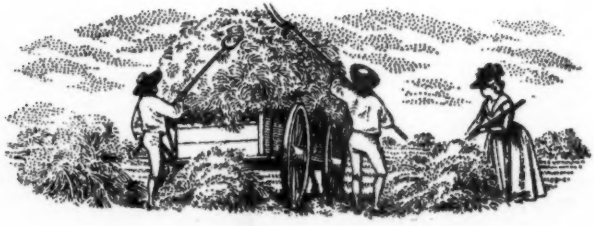

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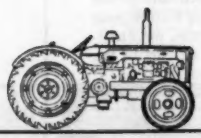

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HOME-GROWN OR PURCHASED FEEDINGSTUFFS?

THE CHOICE BEFORE THE FARMER

V. H. BEYNON, B.SC.

Department of Economics, University of Bristol

Mr. Beynon here outlines a simple budgeting method by which the farmer can determine the profitability of replacing purchased feedingstuffs by home-grown.

IN the United Kingdom the production of livestock and livestock products accounts for 65-70 per cent of the total agricultural output. Costs of providing livestock with home-grown and purchased feeds account for over 50 per cent of the total costs incurred by British farmers. Clearly, therefore, the provision of feed for livestock is a major preoccupation of farmers in this country. Efficient feeding is essential to success in livestock production. This involves paying particular attention to (a) food conversion ratios; (b) rates of growth; (c) prices received for the products; and (d) the costs of purchased and home-grown foods. But an exhaustive discussion of the effect of all such factors is beyond the scope of this article, which is concerned only with the probable effects of replacing purchased with some home-grown foods—that is, achieving a greater measure of self-sufficiency in the use of feedingstuffs.

The subject of self-sufficiency has received considerable attention in this country over the past fifteen years. In the war, scarcity of imported feeds forced British farmers to rely on the produce of their own farms to maintain their stock. In recent years, imported supplies have been more abundant and once again farmers can choose between home-grown and purchased feed. How can they determine the policy most likely to provide the highest incomes? Some claim that if feeds can be produced more cheaply at home then self-sufficiency should be practised to the utmost. Such a course, they maintain, would result inevitably in lower unit costs and higher unit profits. But the welfare of the farmer is dependent not on the profit per *unit* product but on the *total* profit, and it is by no means certain that a greater measure of self-sufficiency would lead to higher profits, even though the cost of production of the feedingstuffs might be well below market prices. Costs of production figures fail to provide the answer to the degree of self-sufficiency most likely to give the maximum farm profits. Data obtained from farm management surveys are also inconclusive, for they show on the one hand some farmers on small acreages who have cut out purchased feeds almost entirely making higher incomes, and, on the other hand, farmers who depend on purchased feeds also enjoying high incomes.

HOME-GROWN OR PURCHASED FEEDINGSTUFFS?

Even on the technical side, information on livestock production is apt to be confusing. In milk production it has been accepted without question for years that very high-yielding cows should not be fed large quantities of bulky foods. Now there are strong advocates for the feeding of these bulky foods *ad lib.*, supplementing them with concentrates. Others consider it inadvisable to feed any concentrates and quote cases of high profits being obtained by feeding cows on such bulky forage crops as kale and silage. There are, then, schools of thought that are vehemently opposed to one another, and the situation to the average farmer is, to say the least, perplexing.

There are very good reasons for this situation. The conditions in which farmers operate in this country vary enormously from area to area, and indeed from farm to farm. Physical factors such as soil and climate are important influences, but are not entirely responsible for these conditions. Standards of management differ considerably, and the resources at the command of the farmer also vary. These differences explain, in part at least, why the opinions of leading agriculturists appear to conflict and why general surveys and costs of production studies fail to provide farmers with straightforward solutions to their problems.

The budgeting technique has been used on an increasing scale in recent years, and it promises to be of inestimable value to individual farmers. Budgeting is nothing more than a means of translating technical knowledge into economic terms, and its usefulness depends on the validity of the technical information and of the economic interpretation. Many farming adjustments are minor in character and their effect on farm income can be determined by means of the partial budgeting technique. This involves estimating (a) the additional costs; (b) output sacrificed; (c) costs saved; and (d) the additional output resulting from changes in the farm policy. If the additional costs plus the output sacrificed together exceed the costs saved plus the additional output, then the adjustment would result in a lower income. But if the reverse is the case, the contemplated change would result in a higher income. (See the illustrations in Tables 1, 2 and 3.)

Dredge Corn instead of Dairy Cake In this article the partial budgeting technique has been used to determine the probable effect of using dredge corn, kale, and grass silage to replace purchased concentrates. It is assumed that the changes involved in these substitutes can be introduced without additional labour, machinery and equipment, buildings, and so on; in other words, these are regarded as fixed costs, and the farmer will not be concerned with them in these examples. But the farmer *is* very much concerned with the additional costs involved in the changes. In Table 1 the change made is the growing of dredge corn. The additional items of costs include seed corn, fertilizers, tractor fuel, binder twine, and possibly contract charges for threshing and baling straw. These are costs over which the farmer has a large measure of control. The additional costs of growing 2 acres of dredge corn are estimated at £19 for a 20 cwt. crop and £25 for a 30 cwt. crop.

The nutritive ratio of dredge corn to dairy cake is 9:1, and therefore it is not a perfect substitute. When mixed with equal weights of grain balancer, the mixture is equivalent in starch and protein to dairy cake. In substituting dredge corn for dairy cake,* the farmer is therefore compelled to pay for grain balancer,* and this constitutes another additional cost.

* The average prices used are £34 per ton for dairy cake and £36 10*s.* for grain balancer.

HOME-GROWN OR PURCHASED FEEDINGSTUFFS?

The effect on net farm income of replacing dairy cake with dredge corn-grain balancer mixture depends on whether the farm is understocked or fully stocked. If the farm is understocked, then the 2 acres of dredge corn can be grown without getting rid of any livestock. The decision whether to grow 2 acres of dredge corn depends on whether the additional costs are less than the cost saved. If this is so, then the change results in additional income.

Table 1

Substitution of Dredge Corn for Dairy Cake

A. Additional Costs of Growing 2 acres Dredge Corn

	cwt.	*cwt.*
Yield per acre	20	30
Total yield	40	60
	£ *s.*	£ *s.*
Seeds	7 17	7 17
Fertilizers	3 8	7 13
Vaporizing oil	1 8	1 14
Binder twine	1 0	1 10
Threshing	2 10	3 15
Baling straw	3 0	3 0
Total	19 3	25 9

B. Effect on Net Farm Income of Replacing Dairy Cake with Dredge Corn (Understocked Farm)

Total yield	40 *cwt.*	60 *cwt.*		40 *cwt.*	60 *cwt.*
Additional Costs	£	£	*Costs Saved*	£	£
Dredge corn ...	19	25	Cake replaced ...	136	204
Grain balancer ...	73	109	Manures on grass ...	4	4
			Baled straw (2 tons)	8	8
Output Sacrificed ...	—	—	*Additional Output* ...	—	—
Additional Income ...	56	82	*Income Sacrificed* ...	—	—
Total	148	216	**Total**	148	216

C. Effect of Net Farm Income of Replacing Dairy Cake with Dredge Corn (Fully-stocked Farm)

Total yield	40 *cwt.*	60 *cwt.*		40 *cwt.*	60 *cwt.*
Additional Costs	£	£	*Costs Saved*	£	£
Dredge corn ...	19	25	Cake replaced ...	136	204
Grain balancer ...	73	109	Cake of 1 cow ...	17	17
			Manures on grass ...	4	4
			Depreciation (1 cow)	10	10
			Baled straw (2 tons)	8	8
Output Sacrificed (650 gal.) ...	98	98	*Additional Output* ...	—	—
Additional Income ...	—	11	*Income Sacrificed* ...	15	—
Total	190	243	**Total**	190	243

What are the costs saved in this case? There is, of course, the dairy cake replaced by the mixture; there are also the manures which were previously applied to the 2 acres, and the 2 tons of baled straw which can now be used to replace purchased bedding straw. In the example quoted, the costs saved exceed additional costs by £56 and £82 at the two yield levels illustrated. Therefore, where there is understocking there are obvious advantages in using the spare land for growing corn to replace dairy cake.

HOME-GROWN OR PURCHASED FEEDINGSTUFFS?

When the farm is fully stocked, any additional land devoted to tillage crops involves selling livestock. In this particular example it is assumed that each cow consumed annually the produce of 2 acres in addition to purchased feed. So one cow has to be sold for every 2 acres of dredge corn grown. Now the additional costs are the same as before, but there is also a sacrifice of output of a dairy cow, which is assumed to yield 650 gallons, the milk being sold at 3*s.* per gallon. The costs saved include two additional items—the dairy cake consumed by one cow (estimated at 10 cwt.) and the annual depreciation on one cow. The net effect is one of £15 income sacrificed at the lower yield and £11 additional income at the higher yield. Therefore, at the levels of costs and returns used in this calculation, there is no clear advantage in growing dredge corn for replacing dairy cake if the output of one cow, valued at £98, has to be sacrificed for each 2 acres of land devoted to dredge. Advocates of a greater measure of self-sufficiency frequently overlook the output sacrificed in growing more tillage crops on fully-stocked farms.

Table 2

Substitution of Kale for Dairy Cake

A. Additional Costs of Growing 2 acres Kale

	tons	*tons*
Yield per acre	12	20
Total yield	24	40
	£ *s.*	£ *s.*
Seeds	1 16	1 16
Fertilizers	8 10	17 0
Vaporizing oil*	3 8	5 13
Total	13 14	24 9

*Including that used for cutting and carting

B. Effect on Net Farm Income of Replacing Dairy Cake with Kale (Understocked Farm)

Total yield	24 *tons*	40 *tons*		24 *tons*	40 *tons*
Additional Costs	£	£	*Costs Saved*	£	£
Kale	14	24	Cake replaced	109	180
			Manures on grass	4	4
Output Sacrificed	—	—	*Additional Output*	—	—
Additional Income	99	160	*Income Sacrificed*	—	—
Total	113	184	**Total**	113	184

C. Effect on Net Farm Income of Replacing Dairy Cake with Kale (Fully-stocked Farm)

Total yield	24 *tons*	40 *tons*		24 *tons*	40 *tons*
Additional Costs	£	£	*Costs Saved*	£	£
Kale	14	24	Cake replaced	109	180
			Cake of 1 cow	17	17
			Manures on grass	4	4
			Depreciation (1 cow)	10	10
Output Sacrificed	98	98	*Additional Output*	—	—
Additional Income	28	89	*Income Sacrificed*	—	—
Total	140	211	**Total**	140	211

Silage and Kale are Profitable The effect of replacing dairy cake with grass silage and with kale is shown in Tables 2 and 3.* It is assumed in these calculations that 30 lb. kale and 25 lb. grass silage replace 4 lb. of dairy cake. Silage has no clear advantage if productive livestock have to be sold before it can be made. But even on efficiently run farms there is surplus grass available in some months of the year, however well the land may be stocked. This situation is likely to persist, and the ensiling of surplus grass for replacing dairy cake should result in appreciably higher farm incomes.

The kale crop has outstanding advantages over most other farm crops. In the first place, it provides very heavy yields of food nutrients per acre, and, secondly, it is both easy and cheap to grow. It is without doubt well worth growing, even when the number of livestock has to be reduced. The partial budget shows that if 2 acres of kale were used to replace dairy cake on understocked farms, the additional net farm income would amount to £99 for a utilized yield level of 12 tons per acre, and £160 for a 20-ton crop. Even on fully-stocked farms, there would be an additional income of £28 and £89 respectively.

Table 3

Substitution of Grass Silage for Dairy Cake

A. Additional Costs of Growing 2 acres Grass Silage

	tons	*tons*
Yield per acre	6	10
Total yield	12	20
	£ *s.*	£ *s.*
Fertilizers	5 2	10 4
Vaporizing oil	1 14	2 16
Molasses	3 0	5 0
Total	9 16	18 0

B. Effect on Net Farm Income of Replacing Dairy Cake with Silage (Understocked Farm)

Total yield	12 *tons*	20 *tons*		12 *tons*	20 *tons*
Additional Costs	£	£	*Costs Saved*	£	£
Grass silage ...	10	18	Cake replaced ...	65	109
			Manures on grass ...	4	4
Output Sacrificed ...	—	—	*Additional Output* ...	—	—
Additional Income ...	59	95	*Income Sacrificed* ...	—	—
Total	69	113	**Total**	69	113

C. Effect on Net Farm Income of Replacing Dairy Cake with Silage (Fully-stocked Farm)

Total yield	12 *tons*	20 *tons*		12 *tons*	20 *tons*
Additional Costs	£	£	*Costs Saved*	£	£
Grass Silage ...	10	18	Cake replaced ...	65	109
			Cake of 1 cow ...	17	17
			Manures on grass ...	4	4
			Depreciation (1 cow)	10	10
Output Sacrificed ...	98	98	*Additional Output* ...	—	—
Additional Income ...	—	24	*Income Sacrificed* ...	12	—
Total	108	140	**Total**	108	140

Reliable Budgeting The foregoing data are primarily designed to illustrate a method of determining the effect of using some home-grown foods to replace purchased concentrates. Its outstanding advantage is that farmers can use information relating to their own milk yields, fertilizer applications, time spent in ploughing, and so forth, instead of averages. As a result, the budget is more likely to be reliable. This study shows that a kale crop undoubtedly has outstanding advantages, even when allowances are made for wide variations in yields and costs. From the economic standpoint, it would appear that no dairy farmer should be without an appreciable acreage of this crop.

TRIPOD HAY IN THE NORTH

J. KNAPE

How do you make your hay? On or off the ground? Mr. Knape's first-hand evidence of good quality hay made in "wet Westmorland" is a cogent argument in favour of tripods.

A WELL-KNOWN farmer, writer and broadcaster recently wrote: "There is, too, another point in connection with this shortage of winter fodder in certain known-to-be-wettish districts, by all accounts largely confined to the smaller farmers. For many years now these men have been advised, urged and pleaded with to make silage, but generally speaking with little effect. Instead, they have continued to pin their faith in haymaking. In spite of disastrous 1954, will they continue to do so next year? After all, silage-making requires no expensive equipment on a small farm—just a mower, some sort of vehicle, something to pull either, and sticking-power."

This seems an unusual reference with which to open an article on the making of tripod hay. It is time, however, that some of the critics of the farmer in the "known-to-be-wettish" districts understood why silage is not made in large quantities. Whatever the wet districts can or cannot do, it is a fact that they *can* grow grass and roots. The smallest farmer grows kale, roots and grass successfully. He has made silage and he has fed silage with his kale and roots, and invariably his stock have suffered from a high incidence of acetonaemia. He has inevitably been thrown back upon the making of hay as the only sure means of adequately feeding his dairy cows and of avoiding a breakdown in his herd. He cannot say why his brother farmers who feed kale and silage do not have similar breakdowns. All he does know is that since he went back to hay, kale and roots, his stock do not get acetonaemia, and he maintains a level milk yield.

Defeating the Rain How, then, did some of the haymaking farmers in wet Westmorland fare last summer? Some suffered disaster, but others harvested their heaviest hay crops in better condition than they have for years. The former, of course, are those who kept to the traditional haymaking methods: the latter are those who made tripod hay. A South Westmorland farm offers a typical example. Here, with 800 Proctor

tripods, something like 70 acres of first-class hay were made, some of it with over 14 per cent protein. The system was perhaps a little unorthodox—but unorthodox only because weather conditions were the basis of the whole adventure—and indeed in 1954 it was an adventure!

For those not familiar with the making of tripod hay, the Proctor may be described briefly as a three-legged stand having two wires around which grass is built up to give a centre air vent. It will carry a total weight of approximately 3 cwt. Explanation of the method of erecting the tripods is clearly given in the makers' instructions. In everyday language, wilted grass is lifted off the ground into what appear, in the distance, to be old-fashioned hubs or pikes. They are indeed virtually the same thing, except that the hay is actually *off* the ground and has a natural air vent in the centre. The crop is cured by the continuous circulation of air. After the tripod is built, the sun plays no part in the making of the rich green fodder.

This farm, a scattered combination of three small units, totals 250 acres; 30 acres of flat meadows and the rest typical hilly Lakeland terrain. The stock consists of a pedigree Ayrshire milking herd of 50 cows with followers, a small pedigree Suffolk flock and 100 Half-bred and Rough Fell lambing ewes. A few Galloway and Galloway × Shorthorns are kept for the roughest grazings. The crops comprise only kale, roots and grass. The 30 acres of flat meadow land and some 40 acres on typical Lakeland hillsides have to be harvested, making the best of every short spell of fine weather. Very rarely during any period of twenty-four hours during the whole of last year's haytime did we have no rain. The hillsides were taken first and, ignoring all weather reports, if a morning broke fine some 3 acres of grass were cut immediately the water was off. As soon as the mower had finished, the driver hitched on his swath-turner and the grass was turned. An hour later the same man tedded the hay continuously for an hour and then left for his dinner. On his return, the crop was tedded again, and then raked by the side-delivery rake into small rows. It was left for an hour whilst the tripods were carted to the field, and then put into big rows. About 5 p.m. the hay was ready for the tripods. It should be noted that seeds grass lends itself much more suitably to quick working than does old meadow grass, where undoubtedly greater care in intensive making is needed and, where possible, two days' wilting is desirable.

It will be seen that one man only was employed in all this preparatory work. Later, five men were put on to these 3 acres, and by 8 p.m. the same day some 45 tripods (15 to the acre) had been made. The actual routine was simple: one man set up the tripods, two men built the base, and two men followed behind "topping out."

Despite all the rain last year, it is a fact that there were very real compensating factors, in that when the sun did appear it usually came with some strength and accompanied by a breeze. Drying conditions for short periods were excellent, and in all cases where a fine day from, say, eight in the morning to eight at night, was experienced, the above procedure was followed. But not all days were like this; so many promised well and then the rain came in mid-afternoon. How then was tripod hay made successfully under these conditions?

When the rain came during cutting, the job was finished and left until the sun and the breeze returned, and then the same procedure as on a fine day was followed. When rain came during tedding, the hay was left in small rows until a few hours' fine spell returned. The whole essence of the undertaking is that never at any time should more grass be cut than can be safely

got together and put on to tripod following three or four hours of fine weather.

We did have one disaster. Two acres had been cut, and then came the rain, which never stopped for more than an hour for over a week. Fortunately the grass was still in swath, but ultimately it took three broken days to make anything of it, and then it went up quite definitely wet in parts. It was clear that this particular piece would mould and suffer in the tripod if it were not closely watched, but by a simple turning device (costing only about 30*s*.) it was found possible to turn the tripods every few days, so ensuring that the breeze reached all sides of the tripod, and good quality material resulted.

Low Cost, Little Labour But I can hear some people saying, "That's all right, but what sort of manpower and capital outlay is needed for this?" Figures never seem to make interesting reading, but it can be said that one man can cut and prepare 3 acres comfortably between 9 a.m. and 5 p.m. and that five men can put up that 3 acres on to tripods by 8 p.m. without undue fatigue or, indeed, without undue haste. But what are the other four men doing whilst the fifth is preparing the 3 acre piece? During the first fortnight of this period they were busy finishing off work on the roots. From a fortnight on they were quite happily engaged in carting in the tripods. It was found that a fortnight to seventeen days was quite long enough to allow the hay in the tripods to mature, and after a period without rain for only something like an hour the tripods were ready to lead in. Imagine the joy of it—rain in the morning, with all its depression—and then a fine afternoon and the old cry, "We have a big lead on!" The capital cost is negligible—only the cost of tripods—10*s*. each, with a ten-year life.

And what of a normal season? First, there can be no question whatever that tripod hay is manifestly superior to hay made in any other way. Secondly, in a good season some risk can be taken in cutting larger quantities which are then left overnight to work up and tripod the following day. Finally, the men themselves, after making hay by this method, have no wish to make it in any other way, and all the well-worn objections prefaced by "Nay m' father allus said . . ." are no longer heard. The face of the wet area farmer in hay-time "hard, set and grey" now takes on a "new look." The cost of labour is little more than for orthodox haymaking, and one has an assured good winter feed.

It is within the means of all of us to make some, if not all, tripod hay, but many of my brother farmers find it hard to change over. As I cleared my tripods finally—some were used two or three times—I offered them to all surrounding farmers. They proved a great boon to many—so much so that I have to confess that the tripods passed from farm to farm and many have not yet been returned!

The following is typical of the prejudice that has still to be overcome. A near neighbour was surrounded by "black hay" which anyone would have hesitated to use even for bedding. He put it on tripods and assured me that it had regained some colour and would at least be "fill belly" and fit to go in his barn. He had only 3 acres uncut, and I urged him to wait for the first fine day and make some quality hay. He promised he would. The first fine day came and with it a favourable weather forecast. The temptation was too much. Two fine days and his hay was in small cock! Is it necessary to add that it so remained for some weeks? This farmer assures me he is now converted to the tripod system. I hope he is. Are you?

SILAGE HELPS OUT THE HAY

FRANK H. GARNER
Cambridge

In East Anglia, Mr. Frank Garner is convinced that it is better to concentrate on making good silage and a little hay, rather than run the risks of full-scale haymaking in the doubtful weather of an English summer.

FOR centuries it had been the custom to make hay for winter feeding, but the time has now come to consider whether the emphasis should not move from hay to silage. This is a pertinent point when we remember last year's appalling summer. If economies can be made in the feeding of hay, it may be possible to make a smaller quantity of better hay and to use an alternative food, silage, despite the prejudice of some stockmen. The following table shows a feeding scheme (designed to make the maximum sensible use of silage with the minimum use of good hay) which I have adopted from time to time in East Anglia. This will be revolutionary to many, but it is nevertheless worthy of serious consideration for the various classes of stock.

Economic Use of Hay and Silage on the Farm

	MAINTENANCE OR BULKY RATIONS
Dairy Herds	
Cows in Milk	
Heavy yielders	Hay
Moderate and low yielders	½ Hay—½ Silage
Cows Dry	
Near calving	Hay
Just dried off	½ Hay—½ Silage
Stores	
6 months till down calving	Silage
Calves	
3-6 months	½ Hay—½ Silage
0-3 months	Hay
Beef Herds	
Cows	Silage
Stores over 6 months	Silage
All calves, except multiple-suckling	Silage
Multiple-suckling calves	Hay
Sheep	Silage
Horses	Hay

Farmers should concentrate on a small quantity of hay made well, rather than a large quantity of doubtful value. Unquestionably, a policy of silage-making run in conjunction with haymaking has many advantages. It will enable farmers to preserve some grass and leys for winter feeding on the farm as silage in a much better condition than they have done in the past when hay has been attempted and spoiled.

Haymaking off the Ground At the present time most of the hay in this country is made by cutting with the mowing machine, leaving the grass for a time to dry, then put into windrows and, weather permitting, carted and stacked. So often, as in 1954, rain falls after cutting and the windrows have to be turned repeatedly before the hay is dry

enough for carting. That turning knocks off the leaf (the most nutritious parts of the clovers and grasses) and the crop becomes splashed with mud. The result is reduced food value. Some hay, indeed, is little better than farmyard manure by the time it is ready for stacking! From the windrows the hay is sometimes picked up by hand by the old-fashioned loaders, and sometimes by mechanical baling machines. Whichever of these systems is adopted, the hay must be dry for carting, otherwise it will go mouldy in the stack. In 1954, in some of the wetter areas, much of the hay made in this way was never fit for baling or carting.

Another method is to put hay into cocks when it is partly made. In the south of England and in Wales the cocks are small and often consist only of several good forkfuls. Such cocks enable the hay to dry slowly and, if properly made, the leaf will not be lost. These cocks will stand light showers, but they cannot resist heavy rain. Once the rain penetrates them they must be opened out completely; even then they will take a considerable time to dry.

The fourth possibility is to make cocks much larger and build them on a frame or tripod. This is the usual practice in many areas in Scotland and Ireland, and in parts of Wales, and it is now extending into some districts of England. In some instances cocks are so large that several cart-loads of newly-cut hay are put into one cock, and the latter may remain in the fields and withstand a good deal of rain until required for consumption in the winter. These cocks are, in effect, small hayricks with a hollow centre.

This same idea of making hay on tripods of various designs can be found in various parts of Europe—in Denmark, Holland, France, Switzerland, Austria and Germany, where I have myself watched the haymaking—and in some other European countries too. In these countries, with an even lighter rainfall than we get in the United Kingdom, the hay is cut and put up on tripods (which may consist of various modifications) when the grass is freshly cut and still very green. It is not allowed to lie on the ground at all. These tripods may have three or four legs, with or without cross-struts on which the grass is placed. Some "tripods" are merely a central pole with cross-pieces of wood which are fitted at various angles to hold the maximum quantity of grass. In some of the mountainous areas of Norway, Sweden, Germany and Switzerland, the hay is hung for drying on wire fences erected across the fields. Here again, the grass is put up immediately it has been cut. Thus by either the tripod or wire-fence method, hay is dried *off* the ground. It remains untouched after it has been put on the tripod or fence until it is ready for carting; no labour is spent in turning it, and experience has shown that it can withstand a considerable amount of rain. After rain it will dry very quickly. In many European countries the hay is carted into barns, where there can be no further drying; consequently it must be placed into these stores in first-class order.

It is true that this method of making hay off the ground cannot be mechanized very easily, but if one is prepared to make a small quantity of really good hay, then it may be worth while in many districts of the British Isles to take great pains to make that hay very well, even if it entails hard work. Time saved from making the larger quantities of hay may be spent on silage.

Making Good Silage Undoubtedly the cheapest way of making silage is by using either grass or long ley and by carting the material as short a distance as possible to the place where it is to be stored. The conversion of arable crops such as cereals into silage is usually expen-

sive, because the crops have to be cut, carted and blown into tall silos. First-class silage can be made from grasses and leys in pits or clamps, and here the only equipment needed is a mowing machine, a buckrake or two, and the necessary tractors. On a dry soil, well-drained pits may be considered, but if there is little or no drainage then clamps should be made above ground. The buckrake can cart the material for silage-making up to a quarter of a mile from the grass field, but for a longer distance than this, the buckrake is a doubtful proposition. By good planning, the distance will, in many cases, be less than a quarter of a mile.

Silage made in this way can be independent of the weather, as long as the men can continue to work outside. Last year in East Anglia I made a considerable tonnage of good silage at a time when neighbours spoiled much so-called hay. If the aim is to make a large quantity of silage, the ideal gang consists of a man and tractor operating the mowing machine, a further two tractors (fitted with buckrakes) and two men, and a fourth, or even fifth, man at the clamp levelling out silage and adding the treacle. The use of treacle is not essential but it is a sound precaution to ensure that good silage is made.

If it can be arranged, two clamps should be open at the same time, filling each on alternate days. This allows settling and gives a slightly better silage. Should this not be possible, it is wise to fill one clamp or stack continuously, provided the men do not work for too long a stretch. If the clamp is being made above ground it can be made with the " up-and-over " system as for a manure heap. After a time the tractors may have to go up backwards and so finish up with a " wedge " of silage. Experience has shown that a weatherproof cover is *essential*, and if possible further weight should be added by soil, by chalk, or baled straw. On cereal farms the latter is quite convenient, since bales, one or more layers thick, can be placed on the top and held in position with wire, so making a heavy roof. Waste waterproof manure bags, if carefully laid beneath the bales, help to keep the wet out. Normally these sacks are quite useless on a farm. In wetter areas the pit could be in a Dutch barn, and straw and hay stored over silage but under cover.

Silage can be used the year it has been made, or it can be kept over for several years. It does not appear to deteriorate by storage, and some farmers have even suggested that its food value is improved by keeping.

SEAWEED IN ANIMAL FOODSTUFFS

I. AVAILABILITY AND COMPOSITION

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In the June 1953 issue of *Agriculture** the use of seaweed as a stockfood was considered by Dr. Black. The considerable interest which it aroused has prompted this up-to-date review of the common brown seaweeds.

THE value of seaweeds in foodstuffs still affords a good deal of speculation. From time to time digestibility and feeding trials with animals have been carried out in several countries, but the results have not always been in accord. Unfortunately in most cases, and particularly in the digestibility trials, the experiments have been of short duration (12 days). However, in the Far East seaweeds have for centuries been an accepted food for humans, constituting up to 25 per cent of their diet. It is stated that people in these countries derive considerable nourishment from seaweeds by virtue of the fact that they have been fed on them since childhood, and the intestinal microflora essential for the metabolism of certain of the seaweed constituents has thereby been set up. In view of this, feeding and digestibility trials with animals should be carried out for a reasonable period, for, if the correct microflora can be introduced, the whole aspect of seaweed as a food might be changed.

Since seaweeds—and particularly the brown weeds—are high in mineral matter (sulphates and chlorides) and contain certain organic constituents which have been shown to have a laxative effect, as well as constituents which are not readily utilized, there is a limit to the extent to which seaweed can be incorporated in the animal diet. This has been borne out by feeding trials, and thus it can only be regarded as a supplementary foodstuff. When fed up to 10 per cent of the basal diet, however, its value is difficult to assess, since it will depend on the diet with which it is fed. Nevertheless, in view of its unique composition, final assessment of its value in foodstuffs should not be based entirely on nutrition figures. Effect on the general health of the animal, productivity, etc., although now well recognized by the many users of seaweed, are, however, difficult to prove scientifically.

Possible Commercial Exploitation Although a great variety of seaweeds occur around the 5,300 miles of Scottish coastline, only a limited number are present in sufficient quantity to justify their commercial exploitation. Between high and low water mark at least a quarter of a million tons of littoral brown seaweed, mainly *Ascophyllum nodosum* (knotted wrack), occur, while from low water down to 10 fathoms (60 feet) an area of 2 million acres supports about 10 million tons of sublittoral weed (*Laminaria* or "tangle"), of which 3-4 million tons are concentrated in quantities of economic value. Two main types of seaweed meal—*Ascophyllum* and *Laminaria* meal—could therefore be available in quantity and, allowing for regeneration, over a million tons could be harvested per year in Scotland alone, giving about a quarter of a million tons of dry material. This quantity may be insignificant when compared with land crops, but it could still make a valuable contribution to our home-produced feedingstuffs.

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* Seaweed as a Stockfood, pp. 126-30.

SEAWEED IN ANIMAL FOODSTUFFS

In common with any plant material, the brown seaweeds, and particularly the *Laminaria*, undergo marked seasonal variation in chemical composition. In the spring of the year, before marked photosynthesis begins, the dry matter is at a minimum and is composed mainly of minerals, alginate and protein. As growth proceeds, there is a marked increase in the carbohydrate content, with a corresponding decrease in protein and mineral matter. With the *Laminaria*, the dry matter content increases from 10 per cent in the spring to 25 per cent in late summer, and the latter period would appear to be the best time to harvest from a carbohydrate point of view. With *Ascophyllum*, however, the seasonal variation is less marked (which has no parallel in any land crop) and harvesting can be carried out at any time of the year.

Like land plants, seaweeds are composed mainly of carbohydrates, fats, proteins and mineral matter, but they are also rich sources of vitamins and many growth-promoting factors. Seaweeds have the advantage over land crops in that they grow in an ideal environment, in which the nutrients in sea water are being constantly renewed by nature, whereas on the land modern methods of intensive cultivation lead to complete exhaustion of the soil, unless, with a knowledge of the nutritional and other growth requirements of the crops, the deficiencies are replaced by man. Seaweeds, therefore, contain all the elements found in sea water, as well as a rich bacterial microflora which contributes to their composition.

Table 1

Typical Analyses of Seaweed Meals (Dry Basis)

	Laminaria Meals		*Ascophyllum* Meals	
	1	2	1	2
Total ash	20.10	27.82	21.93	27.50
Crude proteins	7.44	7.57	8.81	9.11
Ether extract	0.51	1.74	3.28	2.31
Crude fibre	5.65	4.04	3.14	4.02
N-free extractives	66.30	58.83	62.84	57.06
Calcium	1.64	2.46	1.22	1.58
Phosphorus	0.17	0.24	0.12	0.15
Chloride	6.58	—	—	5.98
Starch equivalent	—	49	19	—

Carbohydrates, Proteins and Fats The main carbohydrates found in the brown seaweeds are mannitol, laminarin, fucoidin, alginic acid, and cellulose. The sweet-tasting mannitol takes the place of the sugars of the land plants. In small amounts it is readily utilized and may be partly converted to glycogen, but in larger doses it can have a pronounced laxative effect. It varies from 5 to 25 per cent of the dry matter, depending on the time of harvesting. In place of the starch of land plants the brown seaweeds contain laminarin, which is absent from the *Laminaria* in the spring but which can make up over 25 per cent of the dry matter in the autumn. It behaves towards acids in much the same way as starch, and is as readily utilized as maltose by the bacteria in the bovine rumen. Its presence, therefore, would considerably add to the value of seaweed. No metabolic studies have been carried out with fucoidin, but it is unlikely to be utilized, and feeding experiments have shown that it exerts a laxative effect. Alginic acid, the main cell-wall constituent of the brown seaweeds and bearing some relation to vegetable pectin, has, in some animal experiments, been shown to be utilized, and in others to have a very low digestibility. It is thought to form a complex with proteins, which may explain the negative protein digestibility values obtained in some digestibility trials.

The cellulose content of the brown seaweeds is low compared with land plants (2-10 per cent of the dry matter), but roughage in a diet containing seaweed would be provided by fucoidin and alginic acid—carbohydrates which are probably not utilized but which are capable of absorbing considerable quantities of water.

There is little evidence yet of the general type of proteins present in seaweeds, but the few which have been isolated have been shown to contain all the essential amino-acids (1). The crude protein content rarely exceeds 15 per cent in the spring and decreases to as low as 5 per cent in the late summer. Consequently, the brown seaweeds cannot be regarded as a source of proteins. Red seaweeds, such as *Rhodymenia palmata* (dulse), however, contain 20-25 per cent of crude proteins of high biological value.

The brown seaweeds contain varying amounts of fats—from 1 per cent in the *Laminaria* to 8-9 per cent in the most exposed weed, *Pelvetia canaliculata* (channelled wrack) (2).

Minerals, Trace Elements and Vitamins The brown seaweeds contain all the elements present in sea water and can accumulate some of them to several thousand times their concentration in the surrounding water (3). They therefore contain all the elements so far shown to play an important part in the physiological processes of the animal. Mineral nutrition is a comparatively new science and a great deal has still to be discovered regarding all the elements necessary for health. Sufficient work has been carried out, however, to demonstrate that several of the well-known animal diseases result from trace element deficiencies, and until the whole story is known it is obviously a wise precaution to include in the diet a mineral-rich material like seaweed. Although seaweeds cannot be used as a complete balanced mineral supplement, since they are too low in calcium and phosphorus, these differences can be easily and cheaply adjusted. Seaweeds are also a valuable source of iodine. This is present partly in the organic form as iodine amino-acids, which have been recommended for increasing the milk and butterfat production of dairy cows, for egg production, fattening swine, and for reviving spermatogenesis in bulls and rams.

Table 2

Trace Element Content of Seaweed Meals

(p.p.m. of dry matter)

	Co	Ni	Mo	Fe	Pb	Sn	Zn	V	Ti
Laminaria meal (January sample) ...	.56	2.0	.50	283	10	0.7	117	1.3	19
Ascophyllum meal (January sample) ...	.41	1.5	.69	168	6	1.0	103	1.9	9
	Cr	Ag	Rb	Li	Sr	Ba	Mn	Cu	
Laminaria meal (January sample) ...	1.2	0.7	250	6	3,000	60	30	—	
Ascophyllum meal (January sample) ...	0.7	0.3	80	4	2,600	50	50	4	

As a source of vitamins seaweeds are unique, for not only do they contain the vitamins common to land plants, but also vitamins like B_{12}, which no doubt owe their origin to attached bacteria. Vitamin A is absent (4), but the brown seaweeds contain its precursor, β-carotene (40 p.p.m.), as well as the brown pigment, fucoxanthin, which may also be a precursor of this vitamin. In the B group they contain the vitamins B_1 (thiamine) (5), B_2 (riboflavin) (6), and B_{12} (7) in varying amounts, and it is noteworthy that several of the green seaweeds contain 0.5-1.0μg. B_{12}/g. dry weight, which is as high as that found

in liver—one of the best known sources of this vitamin. Vitamin C (ascorbic acid) is as high in seaweed as in lucerne (up to 8,000 p.p.m.) ([8]). This vitamin is relatively unstable but recent work has shown that it can be stabilized by the addition of sodium alginate, which is one of the constituents of the brown seaweeds. Doubt still exists as to the occurrence of vitamin D_3 in plants, but numerous workers have now shown that seaweeds do have a distinct antirachitic effect ([9] and [10]) and, for example, with chickens it can be fed as the sole source of this vitamin up to the age of 16 weeks.

Since the discovery of tocopherol (vitamin E, anti-sterility vitamin) in soya bean oil, there has been little evidence of its occurrence in other plants. Recent work, however, has shown it to be present in the brown seaweeds in amounts varying from 1 to 35 mg./100 g. dry matter, being highest in the most exposed weeds (for example, channelled wrack) ([11]). This vitamin has been reported to prevent abortion in cattle and barrenness in sows, while eggs deficient in it cannot be hatched successfully. The presence of the vitamins F (pantothenic acid) and K in seaweed has also been reported ([12]). In addition to the above, folic acid, folinic acid, and other growth-promoting substances have also been found ([13]), and work now in progress indicates the presence of antibiotics.

A Useful Supplement The chemical composition, as given in Tables 1 and 2, shows that the brown seaweeds, and particularly the *Laminaria*, could, if harvested at a certain time of the year, be regarded as a source of carbohydrates with some nutritive value, but not as a source of proteins. In general, however, seaweed can be safely introduced into the animal's diet only up to a certain level without upsetting its metabolism. At this level, although not a balanced mineral supplement, seaweeds contribute bulk, major elements, trace elements, vitamins, antibiotics and growth-promoting substances.

Next month: Feeding and Digestibility Trials.

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FARM TESTING FOR BOVINE PREGNANCY, OESTRUS AND SUB-FERTILITY

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Delay in getting cows in calf may sometimes be due to failure or inability to observe that the cow is ready for mating or lacking in fertility. Early diagnosis of pregnancy is also difficult. Some simple tests have been evolved which may prove of considerable value in discovering the condition of the cow.

OVER a period of some fourteen years, experiments have been in progress intermittently on methods for measuring the physical properties of mucin from the uterine cervix of the cow. These secretions are highly complex and little is yet known about their chemical composition. Their physical properties, however, are clearly related to hormonal levels, which vary in such conditions as oestrus ("heat"), pregnancy, and some forms of sub-fertility. This article discusses ways in which this research may be of immediate practical use to the farmer, though it must be stressed that the techniques described are still to some extent at an experimental stage, and that large-scale field trials have not yet been possible.

A common problem in herd management is the reliable detection of oestrus. It is important that conception should take place in the early part of the year, yet it is just at this time when the heat periods of the cow are shortest and when the herdsman has least opportunity to observe oestrus. The incidence of "still heat"—or ovulation without the usual symptoms of oestrus—is also higher during the winter months. Failure to observe oestrus when the cows are due for mating (this is particularly the case where artificial insemination is being used) leads to delay in getting them into calf and subsequent uneconomic running of the herd.

No general survey of the losses due to this delay has been made. We can only quote one small (unpublished) experiment carried out by one of us (F. A. Glover), as a result of which it was estimated that the percentage of oestrus periods missed was at least 25. This figure was obtained from observations on a herd of 80 cows under the care of a reliable herdsman from November to March, when the cows were kept mainly in the stall. We believe that this farmer would welcome some way of reducing this figure, and in this article the basis of a method is suggested which the farmer could use with the help of his veterinary surgeon.

There is, too, an increasing demand for routine pregnancy diagnosis, also with the object of reducing the calving interval in the herd. The method of rectal palpation, in very skilled hands, has been found to give an accuracy of 92 per cent at 6 weeks after conception, rising to 100 per cent at 10 weeks. These figures were obtained by a practitioner of exceptional experience from an experiment on fifty pregnant cows. However, the general opinion seems to be that the ordinary practitioner, who does not have the opportunity of becoming a specialist in the technique, rarely attains 100 per cent success on all cows before 90 days after conception. Rectal palpation will give valuable information on the condition of the uterus and ovaries, and is essential in abnormal cases, but for routine diagnosis it is felt that a method should be considered which is much more objective and which does not demand such high skill and long practice.

FARM TESTING FOR BOVINE PREGNANCY

Various authorities have stated that the most serious wastage in the dairy herd is due to failure to breed. Analysis of the causes of disposal of dairy cows has shown that such failures account for over 20 per cent of the total wastage. Normally, the farmer is unaware of this sub-fertile condition until many attempts have been made to establish pregnancy, involving much time and expense. Within the limits of one research project, it has been observed that some insight into the future reproductive behaviour of an animal may be obtained from measurements on the physical properties of cervical secretions.

Testing for "Heat" All cervical mucus is to some extent elastic; but, in 1941, Scott Blair *et al.* (1) found that, at about the time of oestrus, and only at that time, the mucus, which is then normally very plentiful, shows an unusual property called "flow-elasticity." The secretion, which may be taken for this particular purpose from the vagina (preferably aspirated into a sterile plastic tube), is sucked into a narrow glass tube by means of a hypodermic syringe (Fig. 1), the side tube being kept closed with the thumb. Holding the instrument (called "the oestroscope") horizontally, the secretion is slowly and steadily pushed out again, forming a blob at the open end of the tube. At a convenient point, the thumb is raised from the side tube, thus instantly releasing the pressure. Secretions from cows on heat flow back along the tube, completely or almost completely refilling it. At other times, there is little or no recoil.

Fig 1. The Oestroscope

Many apparently successful tests have been done with this instrument since 1941, in this country, in U.S.A. and elsewhere. Unfortunately, it has not yet been possible to arrange a test on a large enough scale to establish firm figures indicating the measure of its success. Such a test would require not only a large herd available for experiment but, since the bull is the final arbiter as to whether a cow is on heat, the full-time availability of a bull, a skilled herdsman and an experimenter is essential. Cows would have to be served to suit the requirements of the experiment. It is very much to be hoped that such an experiment will one day be possible, since after fourteen years all that can be said at the moment is that, excluding cows which have been treated with hormones, the test appears to work in the great majority of cases.

When the usual signs of heat are not marked and are thus liable to be missed by the herdsman, the recoil in the oestroscope is often incomplete, but it should be definite enough to leave no doubt that oestrus is indeed present. The secretions also undergo certain chemical changes at the time of oestrus, but a chemical analysis takes much longer than the two minutes needed to use the oestroscope.

Diagnosing Pregnancy When in calf, the cow produces within the cervix only small quantities of a tough, jelly-like secretion. By using a speculum and a suitably modified curette, a very small amount of secretion may safely be removed from just inside the cervix. We have taken some 1,500 samples from pregnant cows and, *with careful manipulation, sterilization, etc.*, we have found no evidence of any harm to the cow, nor any increase in the incidence of abortion. There is evidence, however,

that the removal of secretion from cows in early pregnancy causes changes in properties of the mucus secreted to replace it, thus making it advisable, if possible, to test each cow only once.

It has taken some years of experiment to devise a technique for measuring adequately the consistency of minute quantities of secretion and to ensure that a really representative sample is obtained. Recently, however, we have published a paper (2) describing the use of an instrument (the consistometer) only a little more complicated than the oestroscope.

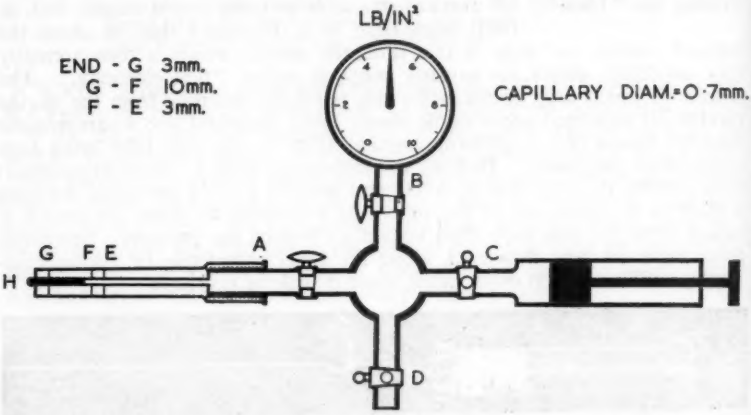

Fig. 2. Apparatus for measuring overall consistency of cervical mucus

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For a detailed account of the use of this instrument, the reader is referred to the original paper, but the principle is quite simple. Keeping taps B and D closed, a very small quantity of secretion is sucked off the point of a pin into the very narrow glass tube from H, until a column, reaching from H to E, is formed. Now closing tap A, opening B, and operating the syringe, a suitable pressure is built up within the apparatus and recorded on the dial gauge. On opening A, the secretion is forced out of the tube, the time taken for it to empty from F to G (conveniently, about 10 seconds) being measured on a stop-watch. This process is repeated once or twice, using fresh mucus from the same sample and different pressures. By averaging the results, a figure for consistency is obtained and, if this figure exceeds a certain value, or if the secretion is too thick to suck into the apparatus, the cow is diagnosed as being in calf. If the consistency figure is below the critical value, or if the sample is too thin to test, the cow is not in calf.

There are three types of case in which this test cannot be used, at any rate in its simple form: (1) cows suffering from disease conditions which affect the secretions—for example, metritis, cervicitis, cervical erosions, etc.; (2) cows which have been recently treated with ovarian or pituitary hormones; and (3) certain cows which are very difficult to get into calf and which give thick secretions when not pregnant. Others give thin secretions when pregnant, though these pregnancies often end in abortion.

Subject to these exceptions (about 5 per cent of the 130 cows in this experiment suffered from disease conditions), preliminary tests show that, at

four weeks after service, pregnancy was correctly diagnosed in 77 per cent of cases, and at five weeks, provided that no sampling had been done at four weeks, a level of 96 per cent was reached. But these figures will doubtless be modified by further experiments now in progress.

The consistency can be measured in a few minutes in the cowshed, but other physical properties, more difficult to measure, also change in oestrus and in pregnancy. For example, the absorption of ultra-violet light of a certain wave-length is greatest when the cow is in calf, less when she is not pregnant, and much less when she is on heat. Such measurements, though less likely to be of immediate use to the farmer, should lead to a fundamental knowledge of the properties of mucus which can hardly fail to benefit the practical man in the long run. Other still more complex physical properties are also being studied to increase our knowledge.

Sterility, Sub-fertility and Abortion Various abnormal conditions in the cow are reflected by changes in the physical properties of the mucin. For research purposes, flow properties should be studied under better controlled conditions than would be possible using the consistometer, and a more complicated apparatus has been designed. The results of tests with this apparatus often correctly foretell an abortion, are indicative of various types of sub-fertility, and can be used to measure with some accuracy the effects of various hormone treatments on cows. Though themselves providing no remedies, such tests are helpful in physiological investigations and in assessing the value of new treatments.

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CHRYSANTHEMUMS FROM LATE-STRUCK CUTTINGS

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Mr. Butters discusses a new method of chrysanthemum growing which, provided it can be fitted in with the glasshouse programme, offers a lower cost of production and easier management without loss of quality or quantity.

THE production of chrysanthemums from late-struck cuttings has now become an accepted technique amongst glasshouse growers, and one in which experience with our varieties and growing conditions is gradually building up so that comparisons can be made with the methods used by chrysanthemum growers in the U.S.A. It is not intended here to discuss the economics of growing from late-struck cuttings compared with the established methods of winter propagation and the long growing season. Some of the advantages of the newer method are obvious—particularly the shorter growing season, ease of management (both outside and under glass), and the control of the plant height that is possible through suitable propagation timing.

These advantages undoubtedly result in a lowering of the cost of production per bloom, and if the chrysanthemum crop could be considered alone, or when the glasshouse is available for planting by mid-July following a French bean, gladioli, or similar crop, then there is no question that this new method would replace the present system. However, the crop has generally to be considered in relation to the nursery programme, and where tomatoes are concerned some loss of crop is inevitable in order to plant the chrysanthemums in the glasshouse at the latest by the third week in August. This loss may not be very great if considered against the labour required to secure a roof crop of tomatoes and the prices usually received for tomatoes from the end of August onwards. It is, however, a consideration that must be borne in mind by the tomato-grower, whose decision must be made according to the running of his nursery and the performance of his crop.

The quality of bloom produced over this short growing season need in no way be inferior to the best commercial standards. Size of bloom is related to the number produced per plant and per square yard, as well as to the general level of cultivation, and it can be adjusted accordingly. The more luxuriant foliage and the lasting quality of the cut bloom have received favourable comment from both the market sales and the retailer.

The knowledge obtained over the past ten years or so, particularly from Dr. Post's work in the U.S.A. on the factors affecting the flowering of the chrysanthemum, has enabled the grower to break with many of the rule-of-thumb practices connected with the established methods of growing chrysanthemums. The reasons for many of these were not understood, and whilst they could produce excellent results in the right hands, they were relatively inflexible and often incorrectly interpreted in many quarters. The complications of bud terminology and the mysteries of stopping dates and times have given the grower an unnecessary respect for the chrysanthemum. Now that most of the factors controlling flowering are broadly understood, he can break a lot of the golden rules of chrysanthemum growing and leave the finer complexities of budding and flowering to the scientists.

Planting and Flowering Programme To be successful with chrysanthemums from late-struck cuttings, a slightly different approach is required. The old technique of slow growing whilst building up a woody plant must be discarded in favour of continuous unchecked growth which, to the average grower, would be considered on the soft side. The standard of production must also be changed from the usual criterion of the number of blooms per plant to the number of blooms per square yard.

The number of blooms that can be produced per square yard is likely to vary between 36 and 54, according to the variety, time of year and quality required. Large-flowered varieties can be planted closer to produce more blooms of a given quality per square yard, and, similarly, varieties flowering during the early autumn, when growing conditions are more suitable, can be put closer together. The number of plants required to produce these blooms will also vary according to the time of taking the cuttings. The later the propagation, the fewer blooms allowed per plant; and thus more plants per square yard will be necessary to give a set number of blooms.

Growing conditions also influence the production per plant in relation to propagating time. For example, the earlier the plants are given the congenial conditions of the glasshouse, the more they can be expected to produce per plant. The following table illustrates this point, in that the direct planting of the late June-struck plants enables them to produce as well as the early

CHRYSANTHEMUMS FROM LATE-STRUCK CUTTINGS

June-struck plants grown on outside and housed in mid-August. The table refers to late-flowering varieties and for growing conditions in the Worthing area. For midseason varieties the dates should be set back about two weeks.

Propagation Time	Planting in Glasshouse	Planting Distance *inches*	Stopping Time	Blooms per Plant	Blooms per Square Yard
Mid-May	Mid-August	12×12	3rd week July	5	45
Early June	Mid-August	9×9	"	3	48
End June	Mid-July	9×9	When established	3	48
Mid-July	Early August	7×8	"	2	46
3rd week July	2nd week August	6×5	—	1	43

Growth from the plants set out directly from the propagating frame should be very quick—at least 1 foot a month—but the final flowering height of the last two batches in the table should not be much more than 3 feet. This will depend very much on variety and size of flower. Good flowers can be obtained on 2-feet stems. The plants struck earlier should reach between 3 and 5 feet, again depending very much on the natural habit of the variety.

The decision as to what programme is followed depends largely on two factors. First, the time the glasshouses are available for planting, and, secondly, the amount of stock material available. There is also the question of the efficient utilization of labour on the nursery, which may influence the choice. At first sight, the single bloom per plant method may seem uneconomic, but there is no doubt that the more plants per square yard the greater the chance of picking 100 per cent top quality flowers. The limiting factor to this method of growing is the supply of cuttings. Whereas the American growers, who are very much in favour of single-stem growing, can order so many thousand cuttings from one of the large chrysanthemum stock growers to be delivered on a certain day, the English grower has to produce his own plants. There would seem to be an opportunity for the establishment of similar firms in this country to produce chrysanthemum cuttings, provided they could be mass produced on hygienic lines and the price kept at a reasonable level.

Propagation There are two methods of raising cutting material. The first follows the usual procedure of overwintering stools in as dormant a condition as possible, either in a cold frame protected with straw or hessian during the worst spells of cold, or in a frame carrying a heating pipe. Growth is allowed to come naturally in the spring, and the lights taken off as soon as possible. Early growths are lightly pinched back, not removed, and cutting material is available well into the summer.

The other system of raising plants is similar to that now standard in the U.S.A. and consists of taking cuttings earlier in the year to be planted out 6 inches square in cold frames in April. These plants are stopped and the resulting side shoots used as cuttings. Several batches of cuttings may be taken from these plants as required. In both cases, a good compost must be used and watering well attended to so that good strong cuttings are obtained. This second method of obtaining cuttings would seem to be essential if a large area is being put down to single-stem growing. The tops of the plants struck earlier can be used for later cuttings at the time of the only stop, which is about the third week in July.

Conditions for the rooting of cuttings should be as near ideal as possible. Any delay or unevenness in rooting will throw the whole programme out.

To this end, propagating frames with bottom heat should be provided. If conditions are hygienic, there is no need for the traditional defoliating of cuttings. Rooting will be quicker and the resulting plants stronger if large, leafy cuttings are used and kept turgid whilst they are in the propagating frame. This type of cutting is obviously more susceptible to poor propagating conditions and infection by rots, but provided the rooting medium is changed and the frame sprayed down with a good fungicide between batches, good results should ensue.

For the best results, the temperature at the base of the cutting should be kept above the air temperature, particularly at night—and this means a bed temperature of about 65°F. in the summer. Electric soil warming wires thermostatically controlled have proved ideal for achieving this condition. The rooting medium should be a coarse sand or grit, and hormone rooting powders have given more even strikes with some slower rooting varieties.

Treatment of the Young Plants Cuttings should be rooted in about three weeks, and those intended for direct planting into the borders (the last three in the table) can be set out in their flowering quarters. They will need frequent damping down, and possibly some shade on the glass to help them to become established. Those intended for later housing must be grown on outside through the summer. A method that has been successful in the Worthing area consists of moving the rooted cuttings into soil blocks of John Innes Potting Compost No. 2 and, after hardening off, planting them outside 6 inches square in beds of spent mushroom compost. There are obviously other ways of growing the plants on until the mid-August housing, but plants bedded in this compost, or in soil heavily dressed with peat, have grown away better after lifting into the glasshouse borders than, for example, those planted out of large 60 clay pots.

Sprayline watering is the only attention which the young plants should require outside, apart from the single stop about the third week in July for late varieties and at the end of June for midseason varieties. Planting is done in long beds down the glasshouse, and a single support of wire and string or wire-mesh string netting is provided.

Feeding and Watering If the chrysanthemum crop follows tomatoes, no base fertilizer treatment is usually necessary; reliance can be put on a feed of John Innes liquid fertilizer at ½ oz. per gallon per square yard every 3 weeks. Other liquid feeds or solid fertilizers can, of course, be used, and a ratio of 2-3 nitrogen : 1 phosphate : 1 potash is likely to be most satisfactory. If the borders have not received a good flooding after the tomato crop is removed, the young chrysanthemum plants should be very well watered in. The chrysanthemum is less tolerant of excess fertilizers in the soil than the tomato, and it is a wise precaution to leach the top few inches of soil to wash out any harmful residues from past manuring.

Magnesium, and sometimes manganese, is required for varieties susceptible to deficiencies of these elements, and when necessary they should be included in the routine insecticide and fungicide spray. Parathion and copper once a month has proved adequate for controlling all pests and diseases, but is only one of several suitable spray programmes.

Temperature control is very important to ensure adequate growth in the time available, and to encourage even bud development through any one variety. Night temperatures of around 50°F. are desirable, and any prolonged period below this level will result in late and uneven budding and

short stems. Bloom colour and shape is also likely to be adversely affected by cold.

Watering is one of the most important operations necessary to achieve unchecked, healthy growth, and it has been amply demonstrated, both in this country and the U.S.A., that maximum plant development can only take place when water in the soil is kept at a constantly high level. Frequent watering is required, particularly over the July to September period, as the chrysanthemum is a comparatively shallow-rooting plant, and also damping over during the early post-planting period. Spraylines are very suitable for this work through July and August, but once the colder nights occur, overhead watering should be discontinued, otherwise foliage diseases are encouraged. Trickle irrigation has also proved satisfactory in maintaining an even, moist condition in the soil.

Successful Varieties Most varieties of midseason and late-flowering chrysanthemums have been grown with varying degrees of success from late-struck cuttings, especially from the May and early June propagation period. Finale and, to some extent, Late Delight and Rose Harrison, have not performed too well, either through very uneven bud development or through becoming excessively soft under the kinder growing conditions provided. Imperial Pink has also behaved badly this past season. giving very uneven flowering, and it seems likely that this variety and the others mentioned require warmer nights during early autumn for satisfactory bud development.

The quick growth made by direct-planted stock is also likely to encourage weak stems and foliage on "soft" varieties; therefore, those having firmer foliage and stronger stems are likely to be the most successful. Typical of these are Balcombe Perfection, Shirley Late Red, Favourite, Friendly Rival, Hadley, Agnes Ford, Autocrat, Fred Shoesmith, and many others of similar type. American Beauty and sports are also satisfactory if not pushed too hard with temperature and water. All varieties, with the possible exception of Finale, can be tried from the May-striking time, until those most suited to the conditions particular to each district, and even to each nursery, are discovered.

Growers new to these methods of chrysanthemum growing would be well advised to propagate a little earlier than at the times mentioned in the table, as this will only mean slightly taller plants at flowering time and will allow a margin of safety should the plants receive a check at any time throughout their growing period. Nursery cropping timetables are easily made but less easily carried out, and this sometimes leads to such common faults with late-struck chrysanthemums as delays in rooting due to poor propagating conditions, plants "drawing up" when rooted before being moved on, underwatering during the summer months, overfeeding and trouble from excess salts in tomato soils, lifting-in plants that have become woody outside, and expecting too high a bloom production per plant and per square yard.

A high degree of skill and crop planning is still required to produce the finest flowers from late-struck cuttings, although once the principles of quick growing and the time schedules have been grasped, there is no going back to the old methods.

SHEEP AT THE CROSSROADS

J. F. H. THOMAS

Broadchalke, Salisbury

Conditions today provide an excellent opportunity for our sheep industry to prosper and expand. But, says Mr. Thomas, sheep farmers must strive by good management and wise breeding to produce what the consumer wants.

OUR sheep industry is now enjoying a more favourable economic climate than it has experienced for many years. A stable price for wool, an assured price for mutton and lamb, and an unsaturated market demand for carcasses of suitable weight and quality, surely point to the fact that we can with confidence expand sheep production in this country. This expansion will be brought about in two ways; by an increase in size of existing flocks, and by starting new sheep enterprises on farms which have carried no sheep during the past fifteen or even thirty years.

The flock-owners of tomorrow will therefore fall into three categories—those who have always kept sheep, those who formerly kept sheep, and those who are new entrants into sheep farming. Farmers in each of these categories can face the future for sheep with confidence, provided they look to the future and not to the past. For instance, the sheep enterprise of a farm must show a clear profit: we must no longer try to justify a loss on sheep by saying that they are kept merely to maintain soil fertility. Next, if we keep a breeding flock we must get as big a margin as possible between the cost of keeping a ewe and the cash value of her gross output. If we produce mutton and lamb for sale, we must offer what the retailer wants, even if it is not what we were accustomed to produce for sale during the past years of controlled marketing.

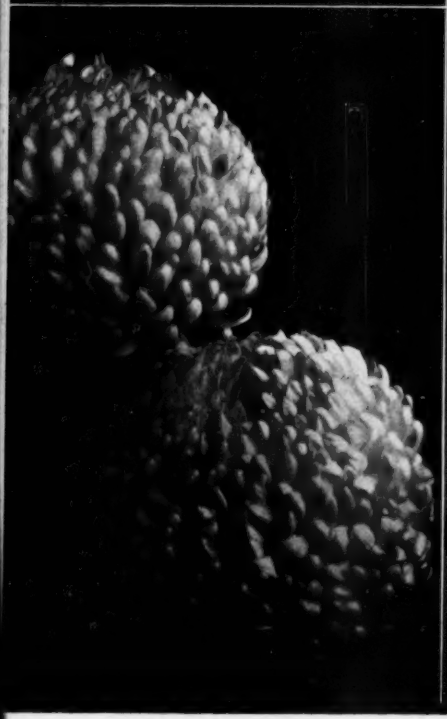
So far as market demand is concerned, two salient points stand out today—the unpopularity of ewe mutton, and the consumer's abhorrence of excess fat in carcasses derived from sheep of any age. Dealing with the first point, ewe mutton is an inevitable by-product of sheep raising, just as cow beef is a by-product of dairy farming. Obviously, we must do all we can to prolong the useful breeding life of ewes now that the gap in value between a breeding ewe and a ewe for slaughter is widening.

Our fat sheep and lambs must be offered for sale at suitable weights and without excessive fat. Contrary to oft-quoted opinion, this does not necessarily mean the doom of some of our native breeds which are large in size; it means merely that if we are producing pure or cross-bred sheep and lambs which are capable of reaching heavy weights, we must *do them well and sell them young*. Under normal conditions of feeding it is not easy to produce excessive fattiness in sheep which are less than 8-9 months of age.

Our longwoolled breeds present a peculiar problem. For certain conditions they are difficult to replace, and their wool meets a firm demand for a particular manufacturing process. We cannot do without long stapled fleeces. But if fully-grown sheep are kept on purely as wool producers, then it is inevitable that their carcasses will not be ideal for the retailer to handle. If we endeavour to reduce the Longwools in size, there is a risk that fleece weights will fall.

Photo: *J. Topham*

Sheep on Romney Marsh, near Ashford.



Photos: *R. A. Malby*

CHRYS HEN

Balcombe Perfection
Gordon Wells

Friendly Rival
Hadley

An article on the production of chrysanthe om

Photos: *R. A. Mal*

RYS THEMUMS

Marjorie Lee
Royal Crimson

Bronze Orange Glory
Autocrat Reflexed

he om late-struck cuttings appears on pp. 19-23.

Photos: *J. F. Seaman*
Farmer and Stockbreeder

Haymaking off the Ground.

Good quality hay can be made on tripods or racks despite the rain.

The Right Land for the Right Breed For any particular set of environmental conditions—soil, climate and elevation—there will be a limited choice of breeds which are eminently suitable, some other breeds which might do fairly well, and other breeds which would be eminently unsuitable! The best results from breeding flocks can only be expected when the type of ewe kept, whether pure or cross-bred, suits the soil, the climate, and the scale of supplementary feeding practised. Broadly speaking, on good land, where food is plentiful, ewes large in body size should be kept. There is a danger that small ewes will get too fat, though the rate of stocking can be higher, with, incidentally, greater risk of loss from ill-health. It is most unfair to expect flocks of ewes which vary greatly in body size to do well, because if the small ewes are done well enough, the bigger ones may be half-starved. On the other hand, if the big ewes are done well enough the smaller ones will become too fat and get "cast", or they will die from some illness of bacterial or physiological causation. In the past many mistakes have been made when a local breed has been supplanted by a breed or type which differs markedly in nutritional requirement. But we must not lose sight of the fact that we can step up the productivity of vast areas of land so that it will carry a *larger* and *more productive* breed or cross-bred type.

Intelligent Breeding The demand for smaller and earlier-maturing sheep to suit the present and future consumer is bound to react on the selection of rams for crossing. It does not of necessity mean that the use of rams of the Down breeds which are largest in size should be discouraged, because rams which sire lambs capable of quick growth and liveweight gain will always be needed to mate with ewes which are good milk producers. If their plane of nutrition is high enough, and they are free from a heavy worm infestation, they will reach good weights at a relatively early age. To produce quick-maturing fat lambs, shortwoolled breeds of ram are best—for example, certain of the Down breeds, the Wiltshire Horn, and the Ryeland. We know far too little about the relative milk-producing capacities of our various breeds; but it is safe to suggest that in sheep, as in cattle, when we select for a high quality of carcass we are selecting against good milk secretion. It is significant that the majority of our deep-milking ewe types are cross-breds which have derived from one of the mountain, hill or moorland breeds.

Of paramount importance today is the need to breed ewes which "twin" well and regularly when conditions and management are favourable to the rearing of a big crop of lambs. This particularly applies when an increasing proportion of the annual lamb crop is being sold off the ewe before the normal weaning age is reached. In the course of time we may see an extension of twice-a-year breeding, but until that comes about the ewe that lives well under lowland conditions is not pulling her weight if she can breed and suckle only a single lamb. In self-maintained flocks of pure breeds there is great scope for selection to raise fertility rates.

Under favourable conditions and with good management, bigger lamb crops and an earlier disposal for slaughter are the fundamentals if ewe flocks are to be really profitable. A good lamb crop is the result of high fertility and a high rate of survival. To secure an early attainment of weight and finish suitable for slaughter, growth and fattening must be continuous and unchecked from birth to slaughter. So we must now consider the causes of growth retardation and poor liveweight increase.

Worm-free Leys for Young Lambs During the first two months of a lamb's life the amount of milk it obtains from its dam is vital. Although lambs begin to nibble during their second week of life, it is not until their second month that substances other than milk can appreciably augment the ewe's milk. They have not at that early age acquired a digestive system which can cope with crude fibre, so supplementary food must be low in fibre content and adequate in digestible protein content. If it is available, nothing will supply this more economically than young spring grass. Here we encounter a problem of the greatest importance and complexity—how to provide young lambs with grazing of high nutritive quality which will not create in them a burden of stomach and intestinal worms of such magnitude that growth and thriving will be retarded. Many lambs on deep-milking ewes make good progress until they acquire a heavy worm burden, and then they begin to scour, they get open in the fleece, and loose their bloom.

We must do all we can to ensure that the heavy worm burden is not acquired by providing a *safe* diet. Dosing with substances known to control worm infestation is a palliative, but can we ensure against early re-infestation? Prevention is much better than cure: if we can farm to produce clean ley swards and to graze sheep in association with other classes of livestock, we can do much to control the build-up of worm infestation which does so much to reduce liveweight gain in sheep.

Those lambs which are not sold off the ewe face another check when they are weaned. Whilst suckled, the effect of their worm burden is cushioned by the plane of nutrition on which they are living. After weaning it is vitally important that the worm burden should be reduced by dosage and kept at a low level by a clean diet. Here we find the advantage of grazing them on swards which have not been grazed by sheep for at least six months; or better still, if the farm rotation permits, of putting them on to crops grown on land which has been under arable cultivation.

Mineral Deficiencies Retard Growth A very interesting but obscure aspect of this problem of worm infestation and its retarding effect on liveweight increase is the question of diet mineral efficiency. There is no doubt that some unthriftiness in young sheep has been attributed to worm infestation when, in reality, serious mineral deficiency in the diet has been the major cause of a debilitated condition. Perhaps in ten years time we shall know more about the part which major and minor elements play in maintaining perfect animal health; but it is a fact that new and improved pasture swards have brought new problems of livestock management to be solved. Metabolic diseases such as pregnancy toxaemia, milk fever, and magnesium tetany still worry the flock-owner. There is also the very interesting problem of the persistence of parasitic worm larvae, in the infective stage, in certain types of sward, whilst in other types of sward which permit quicker drying out to soil level, the viability of worm larvae is quickly diminished.

With regard to mineral deficiencies, we have for a long time recognized the importance of major elements such as calcium and phosphorus, but now it is realized that minor deficiencies can play a vital part in determining the standard of general health in flocks and herds. Copper, cobalt and manganese can be cited as examples of minor elements whose deficiency in the diet can result in a serious derangement of health, with lowered resistance to privation and worm infestation.

Aims for the Future Summing up, we can with confidence keep more sheep, aiming at securing a higher output and longer breeding life in ewes. We must be more careful than in the past about the weight and finish of the sheep and lambs we sell. We must keep a type of ewe, pure-bred or cross-bred, which is best suited to conditions and the scale of feeding adopted. In the choice of rams for cross-breeding, greater discrimination must be shown than in the past. An endeavour should be made to step up fertility rate and milking quality in all breeds by selection of the best lambs reared as twins for breeding. Our management of grazing swards and control of stocking should be planned to reduce the risk of worm infestation. And lastly, more consideration should be given to the need for the diets of sheep to be adequate in minerals, especially certain minor or trace elements.

ALTERNATIVES TO SUPERPHOSPHATE

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Tests with various phosphates have been carried out both during and since the war in an attempt to find a substitute which, while doing the same job, will not make such heavy demands on sulphuric acid in its manufacture. The results obtained are summarized below. Some of the products, however, are not yet available on the commercial market.

SUPERPHOSPHATE is made by treating imported rock phosphate with sulphuric acid, much of which is made here from imported pyrites or sulphur. Regular supplies of superphosphate therefore depend on a regular flow of raw materials. During the war it seemed possible that sulphuric acid might become scarce, and the Ministry of Supply arranged for alternatives to superphosphate to be developed and tested in field experiments. Then in 1950 there was a world-wide shortage of sulphur, and the amounts of sulphuric acid available for making superphosphate were restricted. As a result of this, the Agricultural Research Council initiated field experiments to test phosphate fertilizers which either needed no sulphuric acid in their manufacture or which economized in acid. In this article the results of these two recent investigations have been used to guide farmers on the value of phosphate fertilizers which can be used as alternatives to superphosphate.

The value of basic slag for grassland and for many arable crops on acid soils is already well understood, and this fertilizer should be used whenever it is suitable for particular crops and soils, since the phosphoric acid (P_2O_5) which it contains costs only about two-thirds as much as P_2O_5 in superphosphate.

Direct Application of Ground Rock Phosphates When supplies of acid for making superphosphate are restricted, an obvious alternative is to use ground rock phosphates, where they are suitable. The best phosphates for direct application are the soft rocks from North Africa, and the well-known material from Gafsa was tested in both series of field experiments.

ALTERNATIVES TO SUPERPHOSPHATE

For swedes grown on acid soils (with *p*H values below 6.5), North African rock phosphate was as effective as superphosphate supplying between 60 and 90 per cent as much phosphoric acid. In Great Britain swedes are now restricted to the north and west, where most of the soils are acid and rainfall is high. For most of these crops, therefore, ground rock phosphate could be used instead of superphosphate. (The price per unit of P_2O_5 in rock phosphate is little more than one-third of the price of unit P_2O_5 in superphosphate, if current subsidies are taken into account.)

Mixtures of rock phosphate and superphosphate have been sold in Northern Ireland for many years. In the experiments they were slightly more efficient than the equivalent quantity of rock sulphate for swedes, but, even on acid soils, they were only two-thirds as effective as the same amount of phosphoric acid applied in the form of superphosphate. For potatoes grown on acid soils, the mixtures were only half as effective as superphosphate.

Gafsa phosphate was shown in the experiments to be practically useless for potatoes grown on neutral soils (*p*H values above 6.5), and even on acid soils (*p*H values below 6.5) it was equivalent to only one-third as much P_2O_5 supplied as superphosphate. Rock phosphate and mixtures of rock with superphosphate are not suitable for potatoes.

On very acid soils, finely-ground rock phosphate gave the same establishment and early growth of reseeded grass as only one-third as much P_2O_5 supplied in the form of high-quality basic slag. The more soluble phosphates, such as basic slag or superphosphate, should be used for establishing grassland, but rock phosphates may be used to maintain growth of established pastures on acid soils.

Silicophosphate During the war the Building Research Station of the Department of Scientific and Industrial Research investigated methods of heating rock phosphates with soda ash and sand to produce readily available phosphate, which was called "silicophosphate." War-time field experiments with silicophosphate have already been described in this JOURNAL.* The product was tested again in the 1951-53 experiments.

On very acid soils (*p*H below 5.5) silicophosphate was practically equivalent to superphosphate for both swedes and potatoes. On neutral soils (*p*H above 6.5) silicophosphate was only one-half to three-quarters as efficient as superphosphate for swedes, and for potatoes it was much inferior on both the less acid and neutral soils. For reseeding of grassland on acid soils in the Welsh hills, silicophosphate and Bessemer basic slag behaved similarly.

Silicophosphate can be regarded as having much the same value as a very high-grade, highly-soluble basic slag. It may replace superphosphate for many purposes where soils are very acid, but on less acid and neutral soils it is inferior.

Dicalcium Phosphate Superphosphate contains water-soluble monocalcium phosphate. Dicalcium phosphate, which can be regarded as the half-way stage between rock phosphate and superphosphate, is not soluble in water. Mineral phosphate cannot be converted to dicalcium phosphate just by using less sulphuric acid than is needed for superphosphate. Instead, monocalcium phosphate must first be made and then converted to dicalcium phosphate by adding basic materials like lime or ammonia. In the war-time experiments fertilizers containing dicalcium phosphate were made by mixing slaked lime with superphosphate, but the dicalcium phos-

* Silicophosphate. E. M. CROWTHER and F. M. LEA. June 1946, **53**, 102-5.

phate tested in the 1951-53 experiments was made industrially by dissolving phosphate rock in hydrochloric acid and then adding milk of lime to the solution. Dicalcium phosphate is important, since it is present in most phosphate fertilizers made by dissolving phosphate rock in nitric acid followed by ammoniation, and it is also formed when superphosphate is treated with ammonia.

There was no evidence in any of the war-time experiments on arable crops which tested mixtures of superphosphate and lime, of the increased efficiency which would be needed to justify the expense of mixing superphosphate with basic materials. In experiments on potatoes carried out in 1951-53, pure dicalcium phosphate was more efficient than superphosphate on very acid soils (*p*H below 5.5), but on less acid soils (*p*H 5.5-6.5) and neutral soils (*p*H over 6.5) it was inferior. Phosphoric acid supplied as dicalcium phosphate had around 90 per cent of the efficiency of P_2O_5 in superphosphate for swedes grown on all kinds of soils.

Powdered dicalcium phosphate, such as was used in these experiments, could replace superphosphate for many crops on slightly acid or acid soils. It might not be so satisfactory on calcareous soils or for crops which require a quick start from phosphate drilled near the seed. For these purposes, water-soluble phosphates are likely to be best.

Nitrophosphates Most nitrogen fertilizers are now made by combining nitrogen (derived from the air) with hydrogen to form ammonia. If ammonia is oxidized, the nitric acid made can be used instead of sulphuric acid to dissolve rock phosphate and make it available to crops. When sulphuric acid is replaced by nitric acid in the ordinary superphosphate process the product contains, besides monocalcium phosphate, calcium nitrate, which makes it sticky and liable to cake in storage. Nitric acid processes are now used in a number of countries, but some method of preventing calcium nitrate being present in the fertilizer is usually adopted. The products are called "nitrophosphates." They usually contain ammonium nitrate and have most of their phosphate in the form of dicalcium phosphate.

Three nitrophosphates, made in different countries by three different processes, were tested in the 1951-53 field experiments. All three were inferior to superphosphate for potatoes, but were more useful on acid soils (*p*H below 6.6) than on neutral soils. In each group of soils the best product was only three-quarters as effective as the same quantity of P_2O_5 applied as superphosphate, the second was only two-thirds as good, and the third product was only one-third as effective. In most experiments on grassland 1¾ cwt. superphosphate per acre was sufficient for maximum yields. Both on acid and on neutral soils all three nitrophosphates gave lower average yields of hay than superphosphate supplying two-thirds as much phosphoric acid.

Phosphoric acid in nitrophosphates was practically equivalent to P_2O_5 in superphosphate for swedes, and the three nitrophosphates behaved similarly for this crop.

In the different years of these experiments the same kinds of nitrophosphates have given variable results. It seems that the manufacturing processes have not been stabilized sufficiently to yield products with consistent performances. Phosphate in nitrophosphate behaves in much the same way as that in highly soluble basic slag, and a fair price for P_2O_5 in fertilizers of this kind might be three-quarters of the price of water-soluble P_2O_5. Although phosphates which are not soluble in water may give good results on very acid soils, nevertheless, such soils should be limed to obtain full

crops. It is not in the interests of farmers, nor is it practicable, to suggest that soils should be under-limed merely to allow the crops to use certain kinds of phosphate fertilizer.

Future Uses of the Alternatives These experiments have confirmed the usefulness of the 2 per cent citric acid test for valuing powdered fertilizers like basic slag, silicophosphate and dicalcium phosphate. For ground rock phosphates no chemical test gives a satisfactory valuation, and it is more important to have a description of each product and to know the district from which it was mined.

The experiments have emphasized the value of water-soluble phosphates (such as superphosphate or ammonium phosphate) for most crops and for most classes of soils. No insoluble fertilizers are consistently more efficient than superphosphate. For certain crops, and particularly on acid soils, water-insoluble phosphates may be used when they can be bought more cheaply than soluble phosphate. Newer methods of manufacturing fertilizers are likely to be introduced in the United Kingdom during the next few years to cheapen costs of production, and to obtain high-analysis materials with suitable ratios of plant nutrients. Anhydrous ammonia is a very cheap and concentrated source of nitrogen in many countries, and it may become convenient to ammoniate superphosphate here. If nitric acid can be made cheaply enough, then nitrophosphates may be produced. Both processes give fertilizers containing dicalcium phosphate. The agricultural valuation of these kinds of granulated fertilizers has not yet been settled. It may become an increasingly urgent problem as new manufacturing processes are introduced to keep pace with increased fertilizer usage.

THE NEW VARIETIES OF HOPS

CATHERINE L. JARY, B.SC.
National Agricultural Advisory Service, South-Eastern Province

New varieties of hops to meet the threat of Progressive Verticillium Wilt and to facilitate machine picking have been produced at Wye and East Malling.

IN all crops of economic importance a more or less gradual change takes place in the varieties which are grown. This results from the need for perpetual adaptation to changing conditions—new localities, new cultural methods, new diseases and pests—and from the unending quest for better quality and for higher yields per acre or per unit cost of production. With hops, changes of variety have been relatively slow, partly because they are a long-lived crop and new gardens (yards) are expensive to establish, but mainly because the brewing industry (which constitutes the sole market for the crop) has, in general, been wary of making changes in the types of hop used. This is understandable when it is remembered that the distinctive flavour of a particular beer depends predominantly on the hops. Since brewing is not yet an exact science, and since the precise effects of the various hop constituents are not completely understood (though this matter is receiving close attention at research institutes connected with the brewing industry), it follows that brewers are reluctant to make any changes, the

effects of which they cannot accurately foresee. Not only therefore do they try to obtain the same variety of hop, but they even go to the same source year after year.

Until this century, such new varieties as were introduced arose as chance seedlings selected by progressive growers as being preferable to varieties then grown. In the early 1900s, Professor Salmon at Wye College started the deliberate breeding of new varieties. His first aim was to obtain resistance to mould (Powdery Mildew), which at that time was the most serious disease of hops, but he later concentrated on the development of high resin content (P.V.*), in response to the brewers' insistence that they must have a certain proportion of American hops whose resin contents were considerably higher than those of the English varieties then grown. In fact, he attained both these ends, since some of his varieties (notably Sunshine) are immune to mould, and many others have resin contents higher than those of imported American hops. In many instances, however, these have a strong "American" type of aroma which is not liked by many brewers. This disadvantage has been overcome in some of his later seedlings, in which a high resin content is associated with an "English" type of aroma. These varieties can therefore be used more widely. The best known of those with an "American" aroma are Brewer's Gold and Bullion (of which the latter now appears to be preferred), while among those with an "English" aroma, Northern Brewer is the most popular. Indeed, the acreage of Northern Brewer has shown a quite spectacular increase in recent years.

Growers' Attitude to New Varieties The grower of hops is interested in new varieties in so far as they will give him a greater net profit under his particular conditions than the older ones. This will depend on several factors, but the one which tends to be uppermost in his mind is "valuation"; that is, the price which his hops will command. This is determined partly by the declared variety and partly by a subjective judgment of the individual sample. Although more brewers are now buying hops on analysis instead of mere physical inspection, this has not yet affected the system of market evaluation, which is based on appearance, "rub" (a rough indication of resin content) and aroma. Certain limitations are thus set by the variety, though within these the grading of the sample will be affected by cultural management and by the techniques of picking and drying which are used.

There are of course other factors—suitability for soil and location, yield capacity as *dried* hops, and cost of production (as when additional measures to control disease are needed or more money has to be paid for picking). On wilt-infected farms, the controlling factor may have to be the wilt-tolerance of the variety, and this important matter is dealt with later.

At a time like the present, when hops are at least potenially over-produced, the acceptance of a variety by the brewers is an overriding consideration, and those which are old-established and well-tried hold a definite advantage, compared with newer, though possibly better, ones. The qualities in which brewers are interested are not quite so easily defined, since individual firms

* Certain of the hop resins have marked bactericidal properties and thus function as preservative agents in the beer. Hence the term "Preservative Value" (P.V.) is used to indicate the resin content. These resins also produce the characteristic bitter flavour, and this role is in fact the more important, especially since the increasing use of pasteurization. "P.V." is at present arbitrarily fixed as 10α—the α-resin, consisting of humulone and related substances, being the one mainly concerned.

have different requirements, but their needs may be broadly classified under two headings:

1. Hops suitable for copper boiling ("copper" hops). These are used to confer the characteristic bitterness, and to act as a preservative in the resulting beer. Hops of high resin content (P.V.) may be used for this purpose and indeed should be of some advantage.
2. Hops suitable for "dry-hopping" to produce a delicate hop aroma and flavour in the beer.

The bulk of all the hops required (particularly those in the second category) must have an agreeable "English" type of aroma. Although the grower would like a higher price for his newer varieties, the brewer of course does not want to pay more for them, or certainly not in proportion to their bittering and preservative effects.

The great majority of "copper" hops used in this country are Fuggles, which comprise nearly three-quarters of the total hop acreage. Hitherto, most of the hops in the "dry-hopping" category have been Goldings or Golding Varieties, though Northern Brewer is now finding a place here. The true Goldings are more exacting to grow, in that they need deep, well-drained soils of relatively light texture. Thus no marked extension of their acreage on existing hop land is possible under the present distribution of basic quota. They could not replace Fuggle on the heavy-textured soils with impeded drainage, on which that variety is largely grown. Golding Varieties are rather more adaptable to soil conditions than the true Goldings, but are not such valuable hops and are similarly capable of only a limited extension of acreage. Northern Brewer, however, will grow satisfactorily on the better "Fuggle soils".

The acreage of all the new varieties together is still small compared with the old-established ones, amounting to about 1,300 acres out of a total of approximately 21,000 acres. Approximate figures for the chief varieties are:

	acres
Wilt-tolerant varieties	720
Brewer's Gold	190
Bullion	160
Northern Brewer	90

The three varieties named have P.V. figures of about 80-100, compared with 50-60 in the older varieties.

Call for Varieties resistant to Wilt The indications are that most brewers in this country would probably be quite content with the old varieties (although there is an unsatisfied home demand for some of the new ones and a considerable export demand for Northern Brewer). There are, however, a number of reasons why the position cannot remain static, primarily because of the widespread existence in Kent and East Sussex of a devastating soil-borne disease known as Progressive Verticillium Wilt. This disease now affects about 200 hop farms, representing more than a quarter of all the hop farms in south-east England, and about one-fifth of the hop farms in the country as a whole. The area of land already known to be infected is probably about 3,000 acres, or roughly one-seventh of the total hop acreage.

All the evidence of the past points to the fact that nothing can now prevent the further spread of this disease within and around the main areas already infected. Moreover, the more general use of picking machines is likely to increase the rate of spread. Therefore, unless hop growing ceases altogether

in mid-Kent, the Weald of Kent and East Sussex (and this comprises the most intensive hop-growing area in the country), the varieties now grown there—mainly Fuggle—will in time have to be replaced by newer sorts which are resistant (tolerant) to Progressive Verticillium Wilt. In that case, the potential acreage for such varieties would amount to about one-fifth of the total land under hops in the country.

This situation need not cause alarm among either growers or brewers, since many wilt-tolerant varieties have already been produced and preliminary brewing reports on the newer kinds are favourable. Because the earliest wilt-tolerant varieties were not generally liked by brewers, it does not follow that the newer ones must be similar in that respect. In fact, the greatest care has been taken in the selection of the newer seedlings to ensure that they are acceptable to brewers. This has been done through the co-operation of the Institute of Brewing and the Brewing Industry Research Foundation, which bodies have organized brewing trials with selected seedlings. The brewing, as well as the growing, performance of these new seedlings will therefore be known in advance before they are released. This close and comprehensive link between the two sides of the industry is a comparatively recent development and one which should greatly benefit both in the inevitable extended use of new wilt-tolerant varieties.

Since the scope for new varieties is thus seen to hinge very largely on this factor of wilt-tolerance, it is appropriate to review the history, present position and future prospects of work on this problem. The earliest of these wilt-tolerant varieties were some of Professor Salmon's seedlings, which were tested for resistance to Verticillium Wilt by Dr. Keyworth at East Malling Research Station. Three seedlings showed a high degree of tolerance, and one, OR 55 (Keyworth's Mid-Season), was sufficiently satisfactory to be propagated and distributed under the auspices of the Hops Marketing Board. It saved the situation for growers in the worst affected areas and now occupies about 560 acres. OJ 47 (Keyworth's Early) followed. It was valuable mainly because of its earliness, but was otherwise less satisfactory and only about 80 acres were planted, of which half have already been grubbed. Both these varieties were acceptable up to 1952, while demand for hops exceeded supply, but the position is now reversed and they are not wanted.

Breeding for Wilt Tolerance As already mentioned, deliberate breeding for wilt tolerance, coupled with other desirable characters, has been going on for some years, and many promising seedlings have been produced. The work of selecting and testing, however, takes time, and there are now four or five uncomfortable years to be bridged before these newer seedlings can become available to growers in reasonable quantities. Meanwhile two "stop-gap" varieties are helping to tide over this period. One is "1147"—a chance seedling belonging to a firm of brewers, but recently propagated by them and distributed by the Hops Marketing Board under licence (since the variety was on a "wilt" farm). The other, OT.48 (Bramling Cross), is one of Professor Salmon's seedlings, which has been distributed from Wye College in small lots to growers who have wilt on their farms. Each grower has thus had to build up his own stock, with the result that this variety has been slow to appear on the market in any quantity. More recently, it has been supplied to specialist propagators, and it should now become more generally available.

Of the newer seedlings, the first series was raised at East Malling Research Station in 1946, and four of them (C2, D1, D3 and J2) were selected for

cropping and brewing trials. D1 and J2 appear to be the most satisfactory and, if they continue to fulfil their early promise, they will be released for intensive propagation in two or three years' time. They will then become available to growers in 1959 or 1960. A second programme of work was started in 1950 as a joint undertaking between East Malling Research Station and Wye College, and 3,000 seedlings were raised. Propagation was undertaken at Wye and wilt-testing at East Malling. Progressive selection has been made from these seedlings until now only about 100 are left. Next year it is expected that the final series of tests for wilt tolerance will be concluded, and selection of the successful seedlings will then begin on the basis of growing performance and brewing tests. Final selections will probably not be made until 1960, and a few more years will be needed after that for intensive propagation. It may thus be 1964 before these varieties become generally available to growers.

A different line of approach is also being followed at Wye in the attempt to produce triploid hops. Such hops could have many desirable attributes. In the context of wilt tolerance it might be possible by this means to strengthen desirable female characters by doubling up those factors, while introducing the single factor of wilt tolerance from the male, should this prove to be sufficiently dominant.

There seems every prospect that, as a result of this work, a series of satisfactory wilt-tolerant varieties may eventually be produced to provide early, midseason and late hops useful to growers and acceptable to brewers.

Influence of Machine Picking and Disease Another need, arising out of the rapid development of machine picking, is for hops of tough constitution and a succession of ripening periods. This has to some extent been met, since practically all the new varieties are sufficiently tough and pick well by machine. But only one of them—Early Choice—is sufficiently early. Oddly enough, although this variety has definite advantages for the grower and has secured reasonably favourable brewing reports, it has not been taken up to any extent. This may be due to some confusion with Early Promise—a variety which has now gone out of favour.

The disastrous growing season of 1954 has thrown emphasis on another desirable quality which has hitherto tended to be overlooked by research bodies—namely, resistance to Downy Mildew. Most of the named new varieties and some of the wilt-tolerant seedlings are unfortunately more prone than Fuggle to this disease. The recent appointment of a plant pathologist at Wye College will enable research to proceed on this problem.

In conclusion, therefore, it may be said that the aim of work on new hop varieties is to satisfy both growers and brewers by providing a series of wilt-tolerant, Downy Mildew-resistant, mould-immune, high-yielding, seedless hops with high resin content and pleasing aroma, which will flourish on the soils of the present hop-growing areas. In addition to being acceptable on the home market, the seedless character of such hops would make them directly competitive with Continental hops, so raising the possibility of an increased export trade. This is an ambitious programme which, bearing in mind the many peculiarities of the hop plant, is likely to occupy research workers for many years to come.

GOOD ESTATE MANAGEMENT

THE SHELVE ESTATE

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DURING the last half-century many large estates have, for one reason or another, been broken up into individual owner-occupier farms or into smaller estates. The Shelve Estate, which lies on the western boundary of Shropshire between the Stiperstones range of hills and Stapeley Hill, has, like many others, been reduced in size during recent years, but it has a number of very distinctive characteristics which make it a subject of considerable interest to the student of estate management. Before turning to individual achievements, however, a brief survey of the area in which the estate lies is essential to show the type of land and general physical conditions with which the owner and his tenants have to contend.

In the Shelve area there was once an active mining industry—the Shropshire lead mines (now derelict) being situated in the corner of the county which lies to the west of the Stiperstones ridge and to the south of Minsterley. They occupied two strips of country running roughly north to south, the sites today still being well marked by great heaps of spar and rock, by old workings in the shape of deep trenches, shafts or open pits, and by fallen chimney stacks and ruined buildings—altogether, a sight that detracts severely from the beauty of the Shropshire countryside.

Because of the arching up of the lead-bearing rocks at this point, Shelve has a long history as a mining area; lead was mined here during the Roman occupation, in the Middle Ages, and once again in the nineteenth century. No mines were worked beyond the main road to the west, as the nature of the rock changes from hard rock to soft shale, in which the brook has cut its valley. Two of the principal workings—the White Grit and East Grit mines—lying about half a mile apart to the south of Shelve Hill, were developed to a depth of 600 feet or more. Formerly very productive of lead sulphide ore (they were operating in 1845, when the first official returns were made, and in 1856 were yielding almost 1,000 tons a year), they were finally closed in the late 1860s. Thirty years later the mines were reopened, but only about 300 tons were obtained in three years, and they were once more abandoned in 1901.

Small Family Farms In the summer of 1950 the Shelve Estate was bought by Mr. John Hughes as an investment. At that time the rents on the estate varied from 10*s*. to 22*s*. per acre. Not surprisingly, these rentals had been in existence for many years. The estate is some 1,738 acres, and differs in many major respects from the general conception of an agricultural estate. It once formed part of a much larger estate, and now contains no mansion, estate yard, or estate staff. No agent is employed, and the work of repairs, maintenance and improvement is supervised by the owner himself, employing two handymen for the general repair work and outside contractors for all the major and more difficult work.

The property lies between the 800 and 1,200 feet contours, and is about 14 miles from Shrewsbury; the land is of an upland character, but some of it is quite useful. One or two of the farms are a little inaccessible, but the better type of holding is situated on a main road. In parts the rock is rather near to the surface, although other areas have a very reasonable depth of soil. Texturally, the soil falls into two main classes—sandy grits and sandy

silts or loams. They are not of first quality. The altitude, climate and soils are such that it is essentially a grassland area suited to livestock rearing, and the arable cropping is restricted to the minimum of fodder cereals and roots. There is a fairly considerable rainfall, probably in excess of 45 inches a year. Where reseeding is carried out, it is invariably preceded by a pioneer crop of rape and turnips.

There are on the estate eleven farms, several small blocks of accommodation land, 200 acres of formerly open bracken-covered hill land, one farm cottage and a detached house. An inn, which was originally bought with the estate, has been disposed of by the present owner, but the land going with it has been retained. The farms vary in size from 20 to 177 acres: they are typical examples of family farms, and indeed, as I have already mentioned, there is only one cottage on the entire property. The importance of these farms being run by a farmer and his family cannot be too strongly emphasized, owing to the general shortage of cottages and the lack of labour in the locality. A short distance from the Shelve Estate there existed towards the end of the nineteenth century over forty cottages, all within a radius of a quarter of a mile. These had been built for miners, but none remains today.

A Comprehensive Improvement Scheme In common with other estates in Britain, the depression years of the 1930s and the war-time restrictions on building left their mark at Shelve. There was the usual long list of repairs and improvements awaiting attention. Immediately he took over, Mr. Hughes therefore drew up a programme of work in respect of the whole estate. This was intended to cover a period of several years, and his aim was not only to safeguard his investment, but to increase the capital value and annual return. He has been most enthusiastic over his programme, especially from the farmer's point of view. (This attitude is perhaps not unexpected, since Mr. Hughes has himself farmed for most of his life.) One of his main aims was to improve the fixed equipment on the holdings to enable the occupiers to work these upland farms more easily, and so overcome as far as possible the extreme labour shortage.

The owner has taken great interest in the actual farming operations on his property, and one of his main desires has been to see that the farms are, where practicable, self-supporting. Mr. Hughes realized that this area was not as highly productive as many, and that with livestock rearing as the sole means of livelihood for the tenant and his family, it would be very helpful to the occupier if he could obtain an additional small but regular income. He has therefore provided some accommodation on several of the farms to enable the tenants to keep a small milking herd. In some instances this has meant the conversion of existing buildings, and in others the erection of new. The conversion work has been done very simply and cheaply but to a standard complying with the Milk and Dairies Regulations and giving the tenants a reasonable labour-saving layout. The average cost of the improvement per cow has been as low as £16-17. The aim has not been to change the character of these farms from livestock rearing to dairying, but to make them more of a general type of farm. This certainly has proved an attractive proposition to the younger type of tenant who, probably not having a great deal of ready capital available, has been able to go on steadily improving his farm from regular income.

Water supplies to these farms has also been improved, and the farm programme includes the provision of a supply to the other holdings which have no piped water at present.

The programme of work drawn up by the owner started with repairs to

the detached house. This was followed by improvement and repair work on a 92-acre rearing farm, where the house was modernized, new stock accommodation provided, and a Dutch barn and implement shed erected. A substantial length of new fencing has also been put up to enclose land which was previously open to the road. The fencing comprises posts at 9 feet intervals with small mesh pig-netting between and a strand of barbed wire along the top of the netting. The cost was in the region of 4*s*. 6*d*.–4*s*. 9*d*. a yard. A piped supply of water will be provided. Financial assistance towards the work on this farm is being given under the Livestock Rearing Act, 1951, as the holding is used solely for rearing. On the largest farm on this estate the change of tenancy to the son of another tenant has enabled the estate to undertake a comprehensive programme of modernization to house and buildings, making the latter suitable for milk production. A piped supply of water has been provided.

As other farms have become vacant, the owner has farmed them in-hand, during which time improvements to house, buildings and land have been carried out. As soon as a farm is in a reasonable state, it is let to a suitable young tenant. At all times advantage of the various Government grants available has been taken by the estate.

Reclamation allied to Afforestation A most interesting example of good husbandry moving parallel with good estate management and afforestation can now be seen on an area of land lying adjacent to the Bishops Castle–Shrewsbury road. Up to a few months ago a traveller from Shrewsbury passing through the Hope Valley from the Gravels Post Office to the More Arms Inn, would have seen a large area of land lying to the east covered with a dense growth of bracken. It was separated from the road by an iron hurdle fence, but the northern boundary was completely unfenced, and the hill had been used by neighbouring farmers for rough sheep grazing. Mr. Hughes discussed possibilities of improving this area of land with the Shropshire County Agricultural Executive Committee, and eventually it was decided to make an entirely new holding out of this block of land, together with the 47 acres which had formerly belonged to the inn. As the new farm is to be a rearing farm, assistance from the Livestock Rearing Act, 1951, was available, and progress has been steady.

Parts of the hill, however, were not particularly suited to agriculture and, in any event, cultivation was rather hampered by spoil tips from the lead mines. It was also felt that some of the hill would be very exposed. An approach was therefore made to the Forestry Commission, who had other land in the area, and it has now been decided that 114 acres or so shall be leased to them for afforestation. Not only will there be a useful stand of trees in the future, but they will provide valuable shelter for the adjoining agricultural land. The 114 acres are to be planted by the Forestry Commission this year. The land has been enclosed with rabbit-proof fencing and ploughed, and Scots pine and Sitka spruce will be planted on the ridges at 5 feet square. The object of this cultivation was to break up and aerate the soil and to assist drainage, but it will also, of course, enable the plants to get away quicker before the undergrowth starts shooting again. The Scots pine will be removed during thinning operations, leaving a final pure crop of Sitka spruce.

The holding itself will be about 150 acres. The initial cultivations on this bracken-covered land consisted of ploughing by heavy tackle and discing innumerable times to get a reasonable seedbed. The land was then put down to a pioneer crop of rape, eaten off by sheep, and reseeded the following year.

It has been possible to find a reasonable site on the main road for the homestead, and this will now lie midway between the two extreme boundaries of the land. A satisfactory water supply has been obtained, and it is hoped that very shortly work will begin on the erection of the new buildings and the remaining fencing. There will thus be a useful stock-rearing farm, suitable for a young man making a start in the industry. The house, recently completed, stands at about 1,000 feet, but it will not be too isolated. It has been so sited that it will receive some protection from the very cold east winds by the afforested hill land. Nothing elaborate is to be provided in the way of new buildings, which will include a Dutch barn, cow-ties for nurse cows and a number of loose boxes. The cost of providing the accommodation for the nurse cows and other stock will work out at about £39 per head of cattle housed.

Mr. Hughes also has in-hand a 170-acre stock-rearing farm, known as the Lower House, which he is working with the assistance of two men. On this farm he has ploughed and reseeded approximately 40 acres, and also carried out an extensive drainage scheme. Should he ever decide to let the farm, it could be used as a dairy farm, since the buildings have been modernized to comply with the Milk and Dairies Regulations.

Keen Interest of the Owner It will be seen from the foregoing that Mr. Hughes has been working steadily through a very large programme. He began by doing the essential repairs, followed by the small improvements and work necessary to comply with the Milk and Dairies Regulations where milk was being produced, and has left his largest undertaking until last. Over the past four years, he has taken a keen interest in this work, and several times a week has motored the thirty miles from Oswestry, where he lives, not only to supervise but at times to take an active part in carrying out repair work and cultivations.

There will undoubtedly be an increase in the stock over the property as a whole, and with the improved stock accommodation the ratio of cattle to sheep will be increased. The higher ratio should enable the occupiers more easily to manage the grassland. By creating the new holding, it is anticipated that a further 8 cows and 40 young stock can be kept, as well as a ewe flock of 70.

In addition to two regular farm workers, Mr. Hughes has employed two handymen practically full-time. They have been available, if required, for seasonal work on the farm, but much of the odd repair work has been carried out by them. Such work includes fencing, concreting yards, modernizing cowhouses, etc. The larger work has been undertaken by various contractors outside the district. One of the difficulties in this area is to obtain adequate building labour, but Mr. Hughes has been fortunate in being able to get all this work done without undue delay.

Mr. Hughes's attitude to rent increases is that whilst the rents have been raised slightly he has not felt that it would be right to increase them greatly at this stage. Since some of the work he has carried out was in the nature of repairs, he feels that his return for this particular work will be by capital appreciation rather than rental increases. He has therefore invested for his children. Over the estate as a whole, the expenditure on repairs will work out at about 25*s*. per acre. Very naturally, it is difficult to differentiate between repairs and improvements, and so the figures can be given only as a guide, but it looks as if the *net* expenditure on improvements and new works will be in the neighbourhood of £5 per acre (that is, after taking into account such grants as are available). The work carried out so far has been restricted

to essentials, and all the possible refinements and elaborations has been left until the end. There is much still to be done; for example, Mr. Hughes wishes to see all the property painted, water laid on to all holdings, and so forth. But, with what has been achieved, he now feels that he can carry on with a reduced cost each year for capital work.

This surely is an encouraging example of good estate management on the smaller agricultural estate, of which there are so many in the country. The owner has, of course, made use of all available grants and tax concessions in achieving his ambition to see the estate put in such order as will enable the farms to secure their maximum output.

FARMING AFFAIRS

ANNUAL REVIEW, 1955

THE results of this year's Annual Review of the economic conditions and prospects of the agricultural industry, held in accordance with Section 2 of the Agriculture Act, 1947, are contained in the White Paper (Cmd. 9406).* The White Paper describes the production progress made by the agricultural industry during the past year; the changes in costs and incomes; the Government's production and guarantee policy; and gives the price guarantees determined for livestock and livestock products for the year 1955-56 and for crops from the 1956 harvest.

Production Progress

Unfavourable weather has resulted in a fall in the production of food from our farms during the past year. Net output for 1954-55 is estimated at 53 per cent above pre-war, as compared with 55 per cent a year ago. But for the weather, net output would have been higher than last year, since the increase in the production of pigs and fat cattle more than offsets a decline in the acreage under crops.

Production of milk and eggs is estimated to be slightly above last year's.

Changes in Costs and Income

Costs of production for review commodities have increased by about £39 million a year. Some £5½ million of this is already covered by the feed formula for pigs and eggs. A further £8½ million will have been met by the industry in the production of this year's output, leaving about £25 million increased costs to be taken into account for review (£30 million for all commodities).

Net income for 1954-55 is forecast at £280 million, compared with £320½ million in 1953-54. When adjusted for normal weather conditions, net income is estimated at £312 million for 1954-55, compared with £306½ million for 1953-54.

In spite of the reductions in price guarantees at the last Annual Review, increased efficiency has, as the Government hoped, enabled the industry to maintain its net income (on a normal basis), although unfavourable weather has reduced actual net income this year. Improvements in efficiency are assessed at about £25 million a year for review commodities. Continuing improvements in this direction should offset the effect on future net income

* Obtainable from H. M. Stationery Office, P.O. Box 569, London, S.E.1, or through any bookseller, price 9*d*. (10½*d*. by post).

of the known increase in costs, but the effects of the past season will continue to be felt well into 1955-56.

Production and Guarantee Policy

The Government reaffirms that in free market conditions is not practicable or desirable to set precise production targets for individual commodities. But the Government looks for the maintenance and increase of net output by:

(a) the production of more beef, and more mutton and lamb (particularly if unit costs of production can be reduced); a continued steady improvement in crop yields; skill and economy in the use of concentrated feedingstuffs (10 per cent economy in concentrates would save at least 1 million tons of imports).

(b) The maintenance of a large arable area. Land going out of crops should remain in rotation in the form of leys rather than go down to permanent grass. Wherever possible, the plough should be kept going round the farm.

(c) The improvement of permanent grass and of grassland management generally, accompanied by more effective use of grass and grass products to reduce costs of livestock production.

Development on these lines will help the national balance of external payments by reducing the need to purchase imported feedingstuffs.

The cost of Government assistance per unit of production is particularly heavy in the case of *pigs*, and the Government cannot contemplate any increase in the amount of pigmeat produced. The guarantee has accordingly been reduced. The Government recognize that the bad hay harvest has involved the *milk* producer in exceptional costs, and the guarantee has been slightly increased. There has been no change in the Government's general policy for *eggs*. In view of higher costs, the value of the guarantee for hen eggs will be increased by 1*d*. a dozen. The guarantees for *wheat* and *coarse grains* have been brought closer together by leaving the price of wheat unchanged and increasing the guarantees on barley and oats.

DETERMINATION OF GUARANTEES

The industry should have the necessary resources to continue to develop its efficiency on the lines indicated. The value of the guarantees as a whole, both as regards price and production grants, has been increased by £28 million. The Government's general assessment is accordingly that, with the determinations now made, net income, on a normal weather basis and with the continued improvement in efficiency, should show some increase. The actual outcome will largely depend on the success of the industry itself in bringing down its unit costs of production and getting the best out of the market. The Government's object in this Review has been, while adhering to sound production policies, to help the industry to make good the effects of the past year's exceptional difficulties and enable it to continue its efficient development.

PRODUCTION GRANTS

Details of the increases in the existing production grants, which amount to about £50 million a year at present, are as follows:

	Existing Rate	*New Rate*
Lime subsidy (general)	50 per cent	60 per cent
Lime subsidy (summer months) ...	60 per cent	70 per cent
Ploughing grants	£5 and £10 per acre	£7 and £12 per acre
Calf subsidy	£5	£7 10*s*.
Hill sheep	Nil	5*s*. for 1955 only
Fertilizer subsidy	New rates of subsidy per ton for nitrogen and phosphates involving additional payments of £3¼ million based on consumption in the current year.	

These increases will amount to about £11½ million, based on 1954-55 quantities.

PRICE GUARANTEES

Details of the changes in the price guarantees are given below.

TABLE OF GUARANTEED PRICES

Important Note: For the basis of the prices given below and other particulars of the guarantee arrangements see the Notes on Guarantees in Part II of Appendix V of the White Paper (Cmd. 9406).

LIVESTOCK AND LIVESTOCK PRODUCTS

Commodity	Guaranteed Prices 1954-55	Price Change	Guaranteed Prices 1955-56
	s. d.	*s. d.*	*s. d.*
Fat cattle — steers, heifers and special young cows (per live cwt.)	133 2	+5 6	138 8
Fat sheep and lambs (per lb. estimated dead weight)	2 10½	+ 1½	3 0
Fat pigs (per score dead weight)	51 3 (related to a feed price of 29*s.* 10*d.* per cwt.)	−2 6	51 4 (subject to a reduction of 1*d.* per score in Great Britain) (related to a feed price of 32*s.* 5*d.* per cwt. This pig price is equivalent to to 48*s.* 9*d.* related to the 1954-55 feed price)
Eggs — hen (average per dozen)	4 0	+ 1	4 1½ (subject to a small reduction in Great Britain)
Eggs—duck (average per dozen)	2 9 (These prices for eggs were related to a feed price of 29*s.* 1*d.* per cwt.)	No change	2 9½ (The guaranteed prices for eggs for 1955-56 are related to a feed price of 29*s.* 8*d.* per cwt. and are equivalent to 4*s.* 1*d.* per doz. for hen eggs and 2*s.* 9*d.* per doz. for duck eggs, related to the 1954-55 feed price)
Wool — fleece wool (average per lb.)	4 6 (plus marketing costs of about 4½*d.*)	No change	4 10½ (inclusive of marketing costs)
Milk (average per gallon)	3 1.2	+ ½	3 1.95

CROPS

Commodity	Guaranteed Prices 1955 Harvest, as determined after the Annual Review of 1954	Price Change compared with the 1954 Annual Review Guarantee	Guaranteed Prices 1956 Harvest, as determined after the Annual Review of 1955
	s. d.	*s. d.*	*s. d.*
Wheat (average per cwt.) ...	29 9	No change	29 9
Barley (per cwt.)	24 6	+1 6	26 0
Oats (per cwt.)	23 0	+1 9	24 9
Rye (per cwt.)	23 0	No change	23 0
Potatoes—sound ware (average per ton)	212 6	+4 6	217 0
Sugar beet (per ton, 16.5 per cent sugar content) ...	125 7	+2 6	128 1

Farm and Forest:
1. What Forestry offers the Farmer

Spring, for the forester, marks the close of another planting season, so that he now turns his attention more exclusively to the many other operations that are necessary in well-managed woods. Among them, of course, is the inevitable weeding to prevent suppression of the youngest trees; the brashing and pruning in older compartments; the thinning; and then the conversion of the timber into forest produce, not the least important of which is material for use on the farm.

Forestry, in a way, seems suddenly to have emerged as a major industry in the countryside. This is not surprising, of course, for a great deal of new planting has been going on in the post-war years. The Forestry Commission has planted well over 400,000 acres since 1947, bringing the total area of national forest up to something near the million acre mark. The private woodland owner, who is becoming more and more conscious of the need to replace the trees which were felled during the last war (and, in some cases, even during the First World War), has stepped up his planting from 9,000 acres in 1947 to more than 19,000 acres in 1954. No one can deny the need for forestry and more home-grown timber. We are the least forested country of almost any in Europe, for less than 7 per cent of our land is under trees. The paucity of our woodlands is thrown into greater relief when we consider that small countries like Belgium and Holland have, by comparison, greater areas under forest than has Great Britain. Then there is the important economic fact that we still import more than four-fifths of all the timber and timber products that we use in this country.

All the while there is such a heavy demand on the land in this country—a demand which cannot, in the nature of things, become less—so will the smallest woodland assume economic importance as a source of timber. And even the hedgerows can by no means be discounted. In the latter, as disclosed by the Forestry Commission's census, stands a fifth of our resources in trees suitable for conversion into marketable timber.

All this presupposes forestry's importance to the farmer who, if he is so minded, can take advantage of some of the grant schemes which have been introduced by the Forestry Commission, and which are outlined in the Commission's free pamphlet *Grants for Woodland Owners*.* Thus he can help himself and help at least in some measure to make the country less dependent on timber from overseas. It is possible that the now quite well-known "Dedication of Woodlands" scheme may interest him, though he is perhaps more likely to want to explore the possibilities of the scheme for planting in small woods. This requires the planting of a minimum area of 2 acres in one block on an estate or farm in a year, and provides for the payment of a planting grant of £15 per acre. It has a special attraction where the formation of shelter-belts is envisaged, for provided timber production is a primary object and he uses the right species, the farmer can be assured of a very useful financial return in a relatively short time. There is also a thinning grants scheme, under which payment is made in respect of the first and second thinnings of young conifers, hardwoods or mixed crops, subject to certain limits of height or girth.

Among other schemes, one of special interest to the farmer may well be that which offers grants for the planting of poplars. These run at £8 per acre where the trees are planted in compact blocks, or 2*s*. a tree where they are planted in rows, which may well occupy a piece of land that has never before earned its keep. There are simple conditions as to the minimum acreage or the number of trees in lines which may be planted in order to

* Obtainable from the Forestry Commission, 25 Savile Row, London, W.1.

qualify for grant, and it should be mentioned that not all species of poplar are acceptable. Poplar, of course, can be marketed within about thirty years of planting, and there is likely always to be a substantial demand for it by the match-making and chip basket industries. It is certainly very worth while examining what forestry has to offer the farmer.

The Mechanic on the Farm: 12. Electric Drills In most farm workshops, portable electric drills get such frequent use that it is well worth while giving some time to their regular care and maintenance. It is as well, in the first instance, to buy a heavy duty drill rather than a light one, for the latter is fitted with a smaller motor intended for intermittent use only. The heavy duty type can be used for far longer without getting hot. If the drill is going to be used part of the time as a fixed machine by putting it on to a pillar stand with a clamp and parallel linkage, longer spells of continuous drilling are likely, and this is a further point in favour of buying the heavier model.

Motors on drills have to be powerful; yet if the drill is to be used in the hand, they must not be too heavy. A good system of ventilating the motor is provided on portable drills to prevent overheating, but the apertures tend to allow dirt to enter. Accordingly, the drill should never be laid on a dirty bench while running, for the ventilating air may draw dust into the casing. Of course, no matter how much care is taken, some dirt will eventually accumulate inside the housing, and every few months the drill should be blown out with air from a compressor or tyre pump.

The chuck of the drill should always be opened with the correct key, otherwise the socket will become damaged. It is a good idea to attach the key to the handle by a spring clip.

The flexible electric cable must not be left kinked when the drill is stored, and any grease on the rubber covering of the cable should be wiped off when the job is finished. The wire must be kept well insulated. Small cracks in the covering can be mended by insulating tape, but when the cable becomes badly worn it should be replaced. It gets most wear near the connection at the drill end of the wire, and it is worth supporting it there by fitting a light metal spring over the flexible wire and binding it into place with insulating tape. The spring should be large enough to allow for a good layer of insulating tape to be wrapped round the cable before the spring is placed over it.

A drill can make holes in wood twice the diameter that it can manage in metal. The fluted bits which are supplied for drilling metal can also be used for boring wood, but it is better to use carpentry twist bits for thick wood, because wood dust will wedge in the flutes of the metal bit, thereby increasing the diameter of the drill and causing friction. When alternate layers of metal and wood are drilled in one operation to save marking out, a metal drill bit naturally has to be used for the wood as well. In this case, the drill should be drawn out at frequent intervals to clear the dust from the flutes.

Drills should be switched on before they are applied to the work, since closing the circuit while the drill is under load will result in a heavy starting current which may damage the motor. The current should not be switched off while the drill is still working: the bit should be withdrawn from the work still rotating.

To avoid the risk of electric shocks, it is essential to see that drills are provided with a soundly earthed third wire. This point must be kept in mind particularly when any extension cable is fitted to allow the drill to be used in the yard outside the workshop.

H. J. Hine

Variety Trials of Red Clover It has been suspected for a number of years that some red clover seed passing in commerce in the U.K. has been incorrectly described. This suspicion was borne out by check growing-on trials of red clover seed carried out by the National Institute of Agricultural Botany from 1949 to 1951. In 1952 the Ministry of Agriculture and Fisheries therefore arranged with the Official Seed Testing Station for 42 control samples drawn by the Ministry's inspectors to be grown on, after being tested in the normal way for purity and germination, to check varietal descriptions. The results of the tests revealed a number that were wrongly described, as indicated below:

Double-cut Red Clover (Broad Red Clover). Eleven samples received were described as red clover, English red clover or double-cut red clover. These all belonged to the double-cut type, as indicated by their early spring growth and aftermath.

Single-cut Red Clover. Five samples were described as single-cut red clover; seven described as late-flowering red clover were also treated as being in this group. The majority of these samples were similar in behaviour, although four were later flowering than the true single-cuts, resembling the true late-flowering varieties, and two other samples appeared to be mixtures of double-cut and true late-flowering types.

Late-flowering Red Clover (Montgomery types). Nineteen samples were included in this group. The trial results indicated that fourteen of these were correctly described; two, however, were much earlier, being similar to the double-cut type, while two others closely resembled the single-cuts.

Although this experiment set out to discover whether red clovers were being obviously wrongly described or were of mixed origin, the results also showed quite definitely that there is considerable confusion as to the correct descriptions to be applied to the various classes of red clover. It is therefore recommended by the Ministry that the following descriptions be adopted for red clover in the U.K.:

Variety	Country of Origin
Double-cut or Broad Red	England, New Zealand, etc.
Single-cut	England, etc.
Late-flowering (Montgomery, S. 123, etc.)	Wales, England, New Zealand, etc.

Stockmen's Clubs in Norfolk With its wide variety of soils and low rainfall, Norfolk is justly famous for its intensive production of both agricultural and horticultural crops. Much less is heard of the very considerable livestock population which thrives within the county. There are, for example, over 60,000 cows, producing nearly 38 million gallons of milk a year, and in addition there are large-scale bullock and pig fattening industries. As a general rule the cows, and indeed all livestock, are looked upon as scavengers, and consume the by-products of the arable crops as part of their maintenance ration.

This system of producing milk, beef and bacon, calls for considerable ingenuity both from the farmer and his stockman. After the last war an ever-increasing demand from stockmen for technical knowledge and guidance on recent developments was received by the Agricultural Advisory Service in Norfolk, and as a result, a Committee was formed in 1948 and, within a short time, the Norfolk Stockmen's Club came into being. The first centre for regular meetings was Long Stratton, the membership being restricted to stockmen and small working farmers, and a programme of lectures and discussions on a wide variety of husbandry topics was prepared.

The response from stockmen was so enthusiastic that soon centres were opened in other districts throughout the county. Today there are nine clubs with a total membership approaching the thousand mark. Each centre holds

monthly meetings throughout the winter in a convenient pub. The complete syllabus is prepared in advance and a programme published. In 1948, the governing Committee decided that expansion of membership takes place only after the consolidation of each centre, so ensuring that each has a maximum membership.

Combined visits to places of interest such as the M.M.B. Creameries, bacon factories, are organized during the summer. The highlight of the summer season is the Annual Stock Judging Competition at the Royal Norfolk Show, where members have to judge five in-milk cows, five fat bullocks, and five bacon pigs. Weekend Stockmen's Courses have been held at the Norfolk School of Agriculture, when eminent speakers, such as Dr. John Hammond, discuss recent developments and give guidance on current problems.

During the winter all centres combine in a knock-out Quiz. After an excellent dinner, to which 800 stockmen sat down, this year's finals were held recently in Norwich. The victors were the Gillingham team, the runners-up being last year's winners, Diss. The Quiz-master was Mr. J. H. Anderson, Provincial Director, N.A.A.S., Eastern Province; the co-judges were Professor Robert Rae, Director, N.A.A.S., and Mr. J. C. Mann, County Agricultural Officer, Norfolk.

In May this year sixty members of the Club are paying a fortnight's visit to Holland to study milk production methods.

Norfolk is a large county, and there is still room for more Stockmen's Clubs. The idea may also prove popular in other parts of the country. There is no doubt whatsoever that this system of giving technical advice to the men who handle the farm stock every day is an ideal way of obtaining quick results and improving the standard of livestock husbandry.

W. J. S. Fordyce

BOOK REVIEWS

Plants, Man and Life. EDGAR ANDERSON. Andrew Melrose. 15*s*.

Comparatively little is known about the origins and history of cultivated plants; and the difficulties encountered in any extensive study are great, since such diverse branches of learning as botany, archaelogy, agriculture, and anthropology are involved. This book is a popular account of some of the facts that are known and of many of the unsolved problems of the subject. It surveys investigations carried out by Dr. Anderson and others, the methods used, and the conclusions reached, together with possibilities of further study of plants in relation to man.

The origins and development of cultivated plants and weeds are closely associated with the earliest agriculture and, therefore, with the history of man. The author believes that a study of the attitudes of primitive communities to their associated plants may throw considerable light on the history of the development of crops. He also stresses the effectiveness of the approach to the problem through plant taxonomy, although present-day taxonomists tend to put aside any cultivated plants that come their way.

The effect man has on his environment, and the possible origin of many of our crop plants as weeds of the rubbish piles of early man, are discussed in detail; also the light thrown by cytology on the genesis of plants, the spread of weeds, Vavilov's centres of diversity, etc. Individual crops used as examples include wheat, maize, sunflower, tomato, banana, and cotton.

Altogether, Dr. Anderson has given us an interesting introduction to the subject of the interrelations of plants and man through the ages, and has made very plain the need for much further study into the problem before anything like a complete picture of the history of cultivated plants and weeds can be obtained.

B.J.Y.

BOOK REVIEWS

Man and the Land. L. DUDLEY STAMP. Collins. 25*s.*

Professor Stamp is well known to agriculturists from the land utilization survey which he organized, and for the important part he has taken in town and country planning. He begins this book with an account of Britain (chiefly England, as records for Wales and Scotland are scanty) from the time when the first men arrived here up to the Doomsday Survey of 1086, and shows that even at that early date the pattern of the countryside, or at any rate of lowland England, was already laid down. Most of our towns and villages bear Saxon names, indicating that they are of Saxon origin, if not earlier. Then, using the maps and surveys which later were prepared, he traces the development of the pattern, until by the end of the eighteenth century it was complete so far as the countryman had to do with it. Later came the industrial revolution of the nineteenth century and the enormous growth of the towns with an urban electorate largely ignorant of the countryside and of the countryman's problems, yet with a deciding voice in their government. Hence the difficulties in which agriculture often finds itself, and hence, too, so much of the spoliation that is still going on.

Professor Stamp describes the methods of planning by which it is hoped to avoid the mistakes of the past and ensure the best use of the land in the future. In principle, they seem so good that if the planners could be given a country sense success might be assured.

The book covers a very wide range and the reader will find much of great interest. In describing the changes in the British landscape, Professor Stamp has of course to deal with changes in farming methods, and so he includes a good deal of agricultural history—always a fascinating subject, and it loses nothing in his hands. He has made good use of the large amount of information about the English countryside in bygone days unearthed by students of geography in recent years—some of it extremely interesting. F. W. Morgan's map of Devon, as described in the Doomsday Book in 1086, is given on p. 226, and shows striking similarities with a modern soil map.

Where so much ground is covered there are necessarily matters omitted that might well be included. No reference is made to A. D. Hall's *Pilgrimage of British Farming*, which gives a vivid picture of the renaissance of our agriculture at the beginning of this century. The good farmers of those days were by no means "quaint survivals from the past", as the author suggests; they built up a great pedigree livestock industry and developed new farming techniques that in the end brought back prosperity to the countryside. Also, Exmoor has not defeated efforts at reclamation: the Earl of Fortescue has had considerable success, while the remarkable results obtained by the Earl of Iveagh at Elvedon, and by the Duke of Grafton at Euston, show what can be done on the light Breckland soils. But continuing efforts are needed to keep these marginal lands under cultivation.

The book can be strongly recommended to the countryman wanting to know something about the land in which he lives, and it will give him a good deal to think about.

E.J.R.

The Fruit, the Seed and the Soil (John Innes Leaflets 1-9). Oliver and Boyd. 5*s.*

In the third collected edition of these useful leaflets, several authors have taken the opportunity to bring their contribution up to date and included new material where it seemed wise to do so. The subjects dealt with are likely to interest all growers, gardeners and seedsmen and keep them in touch not only with the progress research is making in many aspects of horticulture, but in the application of the discoveries to the day-to-day work of crop production in gardens, glasshouses and fruit plantations.

Leaflets 1, 2, 3, 4 and 6 are related and progressive, and explain the now well-established John Innes's methods of soil composting and the raising of seedlings, and the outdoor culture of tomatoes. Leaflet 5 stands rather by itself, since it relates to fruit trees and the fertility rules in fruit planting—a subject that concerns every grower contemplating the establishment of a new plantation or the extension of an old one. Leaflets 7 and 9, on growing pure seed and making new plants, have a special appeal to seedsmen, nurserymen and amateur gardeners, any of whom might well profit from the careful study of the ideas, suggestions and methods which these two leaflets present. Leaflet 8 deals with the cultivation of sweet corn in England—a crop brought very much to our notice during the war and one still worth serious consideration. Sweet corn adds variety to our diet, and the availability of high-yielding varieties and hybrids suitable for growing in our climate, allied to the increasing public demand for the cobs, will probably encourage both domestic and commercial cultivation of this interesting vegetable.

H.W.M.

BOOK REVIEWS

Farm Animals in Health and Disease. W. R. WOOLDRIDGE. Crosby Lockwood. 30*s*.

Dr. Wooldridge is to be congratulated on having succeeded in condensing into one volume the essential up-to-date knowledge required by livestock breeders and farmers to enable them, with the help of certain subsidiary literature and advice from specialists, to produce and rear their farm animals and poultry in health, as far as is humanly possible.

In the first part of the book, the author briefly explains the functions of the organs, and describes in simple language the extremely complex physical and chemical processes that occur in the animal body. He then deals with the essential components (including the various vitamins and trace elements) of feedingstuffs needed to keep animals and poultry in health. The causes, indications and estimated costs of ill-health are reviewed in general terms. Bacteria, viruses, parasites and other living agents are referred to without scientific detail, except where a knowledge of the life history is necessary for preventing or combating the resulting disease. Malnutrition, deficiencies and poisons (both mineral and vegetable), which may cause ill-health, are considered, before going on to deal more extensively with the control of disease by legislation, treatment, prophylaxsis, sound nutrition, sound genetics and hygienic husbandry.

In the second part, the numerous diseases of each species of farm livestock are preceded by a few introductory paragraphs on the industry and general management. There is a chapter for each species, and it is gratifying to find that chapters have been devoted to the ailments of goats, poultry and rabbits, in addition to those on the diseases of cattle, sheep, pigs and horses. The notifiable and common diseases of both young and old are described, together with an indication of first-aid treatment and measures for prevention and control. Throughout, there are references to the role of antibiotics.

Just as quantitative details of balanced diets were omitted in the first part of the book, so also the specific treatment of disease has been wisely left out from the second part. The livestock owner is advised to be observant, to keep records and to obtain professional advice at an early stage of the disease.

If every farmer possessed this book, read it, referred to it regularly, and acted on the advice which it contains, there would soon be an improvement in animal health generally, and the nation would be economically richer. It should provide the enthusiastic reader with the stimulus to delve deeper into abundant literature on nutrition, animal management, grass and pasture management and genetics.

The book is attractively presented, generously illustrated, both with text figures and photographs, usefully tabulated, and adequately indexed.

B.A.C.

The Dexter Cow and Cattle Keeping on a Small Scale. W. R. THROWER. Faber. 18*s*.

Dr. Thrower's book can be commended unreservedly for its essentially practical value to newcomers to cattle keeping. It is full of helpful information, much of which indeed will be of real interest to all cattle raisers, whatever their choice of breed. The chapter on animal health is particularly good.

As the title indicates, the author is primarily interested in Dexters, and he has presented an excellent introduction to the keeping of this delightful breed which should give the beginner a clear idea of what to expect. Suggestions for calf rearing and feeding for milk and beef are based upon practical experience. A strong case is made for the Dexter as a producer of cheap milk and baby beef, and its suitability for crossing with beef breeds is duly emphasized.

Dr. Thrower is to be commended for his frank approach to the subject of bulldog calves. Most text-books mention this as a potential drawback to the keeping of Dexters (usually omitting to say that bulldogs, or abnormal calves of one sort or another, are likely to occur in other breeds), but much of what has been written is, to say the least, inaccurate. Dr. Thrower, having kept Dexters for some years, can claim to write with first-hand knowledge, and his comments should go a long way towards putting the subject into the right perspective. Rather wisely, he refrains from siding firmly with any of the numerous theories on the subject. He refrains equally from categorical statements about the origin of the breed. This is still obscure, though its descent from the original Celtic cattle seems fairly certain, as remains found in prehistoric forts in Ireland and references in medieval manuscripts indicate.

The text is written in good, plain English and is well supplemented by clear drawings. It is rather a pity though that there are not more and better photographs.

W.R.N.T.

BOOK REVIEWS

Progress in Milk Production. J. CLARK and J. E. BESSELL. I.C.I. (Central Agricultural Control) Bull. No. 5.

This bulletin is drawn up from records provided by 40 dairy farmers who co-operated with the Agricultural Development Department of I.C.I. in farm management investigations during the four years 1949-52. These were critical years with changing conditions for milk producers and, as the report so rightly stresses, it was difficult at times to assess improvement, bearing in mind the inflationary tendencies of the period.

The main items of cost of milk production during the four years remained fairly constant: foods accounted for 61 per cent of total cost, labour for 22 per cent, maintenance 4 per cent, and overheads and sundries 13 per cent. Although the cost of milk production rose by £13 14*s.* per cow (18 per cent) and 3.7*d.* per gallon over the four-year period, a greater rise in milk receipts raised profits by £7 10*s.* per cow and 5.8*d.* per gallon. Despite a 50 per cent jump in the price of concentrates, there was only a slight increase in the average expenditure on this item, due to a reduction in the amount fed per cow. Reductions were also made in the quantities of hay, straw and roots fed. The investigations emphasize that grass is the cheapest source of starch equivalent, and it is shown that by making greater use of grazing and silage a saving of £5 per cow was possible in 1952. By better grassland management, increased use of nitrogen, and the introduction of more intensive methods, it was possible to increase milk production per acre by as much as 16 per cent. Cropping changes during the inquiry were only slight, stocking density increased by 10 per cent, and there was no increase in labour.

There are some interesting, enlightening and valuable data in this bulletin which are worthy of detailed study by all concerned with milk production, whether on or off the farm. Outlines at the beginning of each chapter provide a concise summary of the more detailed information contained therein, and make for easy reference. Undoubtedly the farms in the national investigation will be more representative of normal farming practice than the farms in this particular investigation, but the information collected during the four years and collated here is most useful in pointing the way to others seeking improvement. As the title implies, there has been progress in milk production on these 40 farms, and such progress cannot be ignored.

A copy of the bulletin can be obtained free from Imperial Chemical Industries Ltd., Central Agricultural Control, Bolton House, 61 Curzon Street, London, W.1.

B.T.

Diseases of British Grasses and Herbage Legumes (2nd Edition). KATHLEEN SIMPSON and J. H. WESTERN. Cambridge University Press. 15*s.*

The first edition of this book, published in 1941, quickly established itself as an esential work of reference for plant pathologists and all others specially interested in the health of one of our most important crops—grass. Those not fortunate enough to possess it will welcome the appearance of this new edition.

Although the book has the same basic arrangement as the original edition, the authors have incorporated in it the results of important research carried out in the last ten years, and, where necessary, have amended the nomenclature of the fungi concerned. Clear, concise descriptions are given of all the diseases likely to be encountered on individual grasses, turf, and herbage legumes in Britain, and are supplemented by eleven excellent plates and fifteen line drawings. The accounts of diseases of little economic significance are necessarily brief, but more space is devoted to those which have assumed increasing importance in recent years. The sections on ergot, "choke" of cocksfoot, blind seed disease of ryegrass, and clover rot, summarize the advances that have been made in the study of the problems caused by these diseases. They also indicate the need for further investigation to provide satisfactory practical solutions. In the case of turf diseases the position is happier, though the account of the development of new fungicides in America and Canada is tantalizingly brief. However, this brevity, and indeed that of the whole book, is to some extent compensated by the valuable bibliography, which now includes the titles of over five hundred original papers.

The quality of the production is an improvement on that of the first edition, especially in the provision of covers and binding more likely to withstand the frequent usage to which it will be subject. Satisfaction at this is tempered by the fact that it has been necessary to treble the original price! Nevertheless, it is still very good value for money.

H.E.C.

BOOK REVIEWS

Concrete Farm Structures. A. M. PENNINGTON. Concrete Publications Ltd. 12*s*.

This slim volume is a compact and useful addition to the bibliography of farm buildings, presenting in its 150 odd pages a mass of information which, at times, leaves the reader breathless.

In his preface the author has indicated that this is the first of a number of books to be published on this subject, and he has therefore limited the scope of his investigation to the more simple forms of concrete block construction. It is a little disappointing, however, that the chapters on storage buildings for both livestock and materials deal so little with precast and pre-stressed forms of frame construction. Apart from a cursory description of the Dutch precast building, the interesting possibilities of the material for panel walling have been ignored. Some reference to proprietary types of labour-saving structural forms would also not have come amiss in view of the research which is nowadays being devoted to the subject of concrete.

The tabulated information is generally well presented, and is of the kind which, although most useful to designers of farm structures, is often difficult to find elsewhere without much searching. The book is also profusely illustrated, but the diagrams, although detailed, are at times too small to be readily decipherable, and the lettering suggests hurried preparation. Similarly, many of the photographs could, with advantage, have been larger.

One or two points of contention arise. Thus, although reference is made to the necessity for insulating piggeries, it is noticed that the interior in Fig. 44 shows an uninsulated asbestos roof. It would be interesting to know what remedies its owner has by now been obliged to adopt! The exercise yard for bulls in Fig. 19, too, seems hardly adequate. But in a book of this type, in which the author has attempted to cover a whole range of fixed equipment, there are bound to be points at which criticism can be levelled. In any case, there are probably more differing views on farm buildings than on most other agricultural subjects.

This is a book for everyone on whom the responsibility for the design of farm buildings falls; a book to be kept in the pocket or in the back of the car, a "vade-mecum," a source of reference which in course of time is destined to become well thumbed.

F.W.H.

Classified Glossary of Terms relating to Agricultural Machinery and Implements. B.S. 2468: 1954. British Standards Institution. 6*s*.

Implements of farming have a long enough history for some of their names to have suffered local variation, and for others to have been outmoded by the descriptions used for similar mechanisms employed in other branches of industry. This is true both of the complete machines and of the component parts. The use of local or old-fashioned names caused no trouble in the days when the implements had a local character and were made by the village blacksmith, but now that implements are made in a few large factories and sent all over the country, and often all over the world, a universal notation is essential. It behoves all farmers and implement dealers to get to know the correct, or accepted, name for the tools they use and sell. The object of this Glossary has been to standardize and co-ordinate the meaning of the terms, and it is hoped that the name decided upon by the B.S. Committee will gradually replace local or less appropriate nomenclature.

This first edition is incomplete, but it has set the framework into which more and more items can be placed in future editions. This framework is a decimal system of numbers which provides a method of classifying each implement and part. Figures are very suitable for international application, and their use may do away with many language difficulties.

Some of us who have been using and talking about farm machines for a long time may find descriptions in this Standard which are new to us and appear to be wrong; for example, although a mower knife section is still to be called a mower knife section, the other half of the scissors-cutting mechanism on the cutter bar is to be called a finger liner, and not a ledger plate; and what we always thought was a plough breast is now a mouldboard. This does not imply that the compilers have failed to choose the most appropriate, or most generally used, terms. It may, indeed, suggest that the reader is parochial and out-of-date on a matter in which quaintness may result in a wrong spare part being provided for some machine at a critical time. The important point is not that we should like the sound of the words, but they should become universal. Acceptance and use of the terms set down in this Standard will bring considerable benefit to the implement trade and therefore to the farmer.

H.J.H.

BOOK REVIEWS

Romney Marsh. (Regional Books Series). WALTER J. C. MURRAY. Hale. 18*s*.

Romney Marsh has been well described as a "gift from the sea". Mr. Walter Murray's description in the early chapters of the evolution and ancient history of the Marsh is therefore most interesting, even if the subject is, at times, dealt with a little laboriously. The rise and fall of the land over the past 12,000 years to the final fall well below high-water mark; the accumulation by wave action of shingle at Dungeness, which grows steadily greater; the sand dunes at Camber and Greatstone; all are carefully accounted for. Obviously the author has done a good deal of research.

"It is a place apart. It is neither Sussex nor Kent." So says the author in his opening chapter. Romney Marsh is, of course, far from being a marsh in the true sense of the word; it is probably best known for the excellence of its pastures, which are capable of fattening ten to fourteen sheep per acre. Thus we might expect to see farming figuring prominently in this book. The twenty pages devoted to the agriculture of the area are, however, disappointing. The reader is left with the impression that Mr. Murray made a good deal of use of the Agricultural Land Commission's Report, and in doing so overlooked the vast changes that have taken place since the Commission did their work. The observant eye can see fresh acres being ploughed—pasture that has never before in living memory been ploughed; land being tile-drained; ditches being cleaned out and straightened to facilitate better drainage and easier cultivation; new farm buildings, farmhouses and cottages being erected; new techniques of growing crops arising; ploughing and cropping being taken right up to the very edge of the dykes or sewers. Of the new leys which fatten more sheep per acre than some of the well-known fattening pastures; of the use of gang mowers to control the grazing so the "sixpence might be found"; of all this, I feel, much more could have been written.

Birds, Dungeness Beach and Pett Levels go together, and the writer has a keen love of all three. His description of Dungeness—"It is unique, it has such charm, such spaciousness, such wildness, it is a desert island between the sounding sea and the green levels of the Marsh, it has its own exquisite flora, its rare birds, its insects, it is a place where few come and go"—is very apt. But, in my opinion, too much space is taken up with the better-known landmarks of Dungeness, Camber, Pett Levels, Rye and Winchelsea, to the neglect of Romney Marsh proper. Its villages, its churches and scattered farmhouses, Newchurch, with its 700-year old church, Brookland, with its quaint church and tower, Burmarsh, St. Mary's-in-the-Marsh, Ivychurch, Fairfield and many other delightful spots receive only brief mention. Aldington Knoll, 212 feet above the Marsh, and offering some fine views of the area, is also well worth a visit.

If the author has a weakness, it is a tendency to stray from the subject. In the last chapter, for example, the reader, while wandering through "The Towns and Villages of Today", is invited to consider water control in the canal and sewers, the Agricultural Land Commission's Report, frogs, butterflies and moths, land yachting and fishing. Nevertheless, Mr. Murray has a pleasing and sometimes poetic style which makes the book very readable, and I would not hesitate to recommend it to all who wish to know more about the Marsh and its history.

The book is well illustrated with photographs, maps and drawings, and, with the exception of a transposition of the numbers of the chapters, is well presented.

O.M.

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